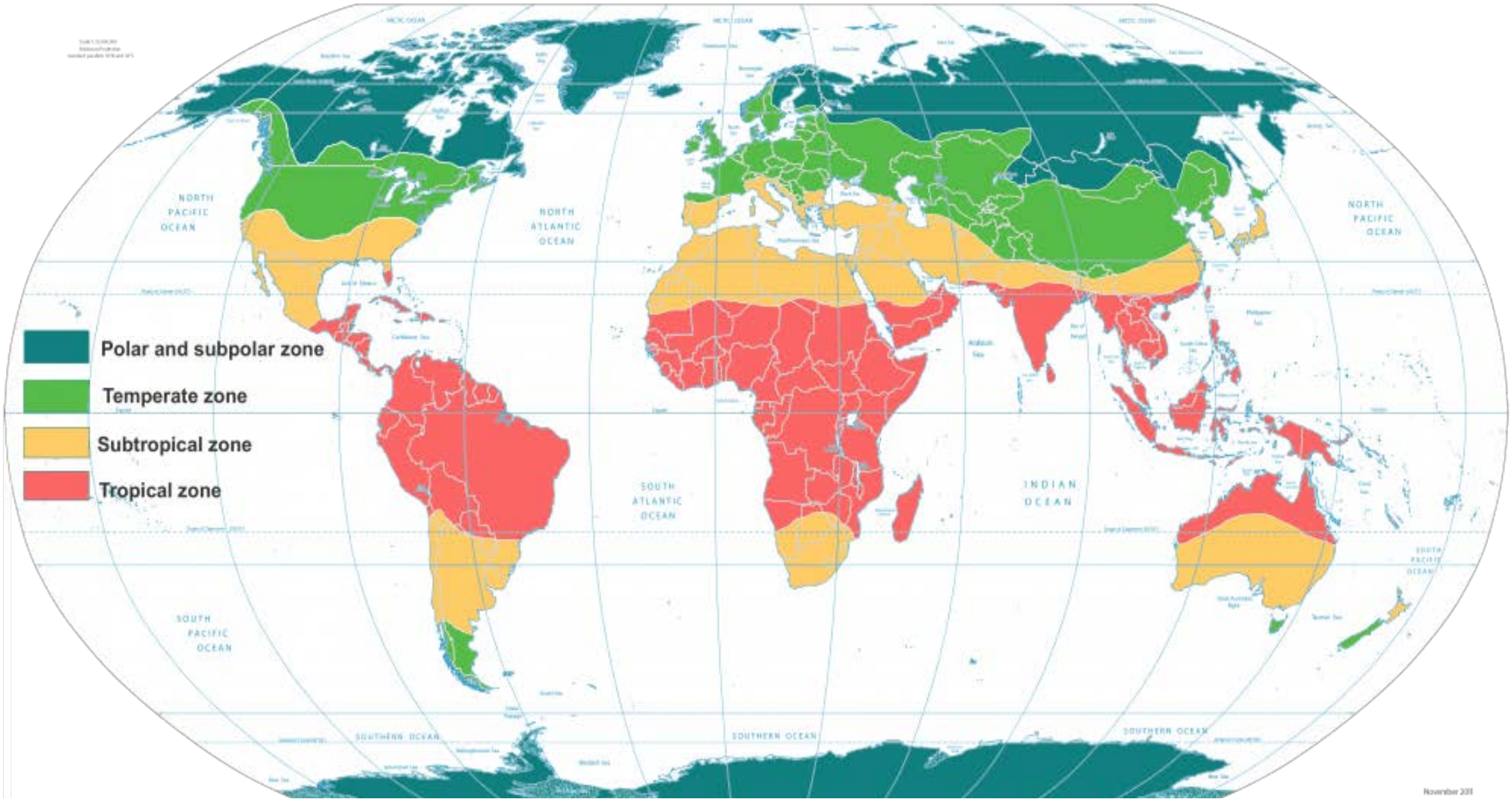
Call for Action:

Implementation & Integration of Climate Medicine into Medical Education Curriculum

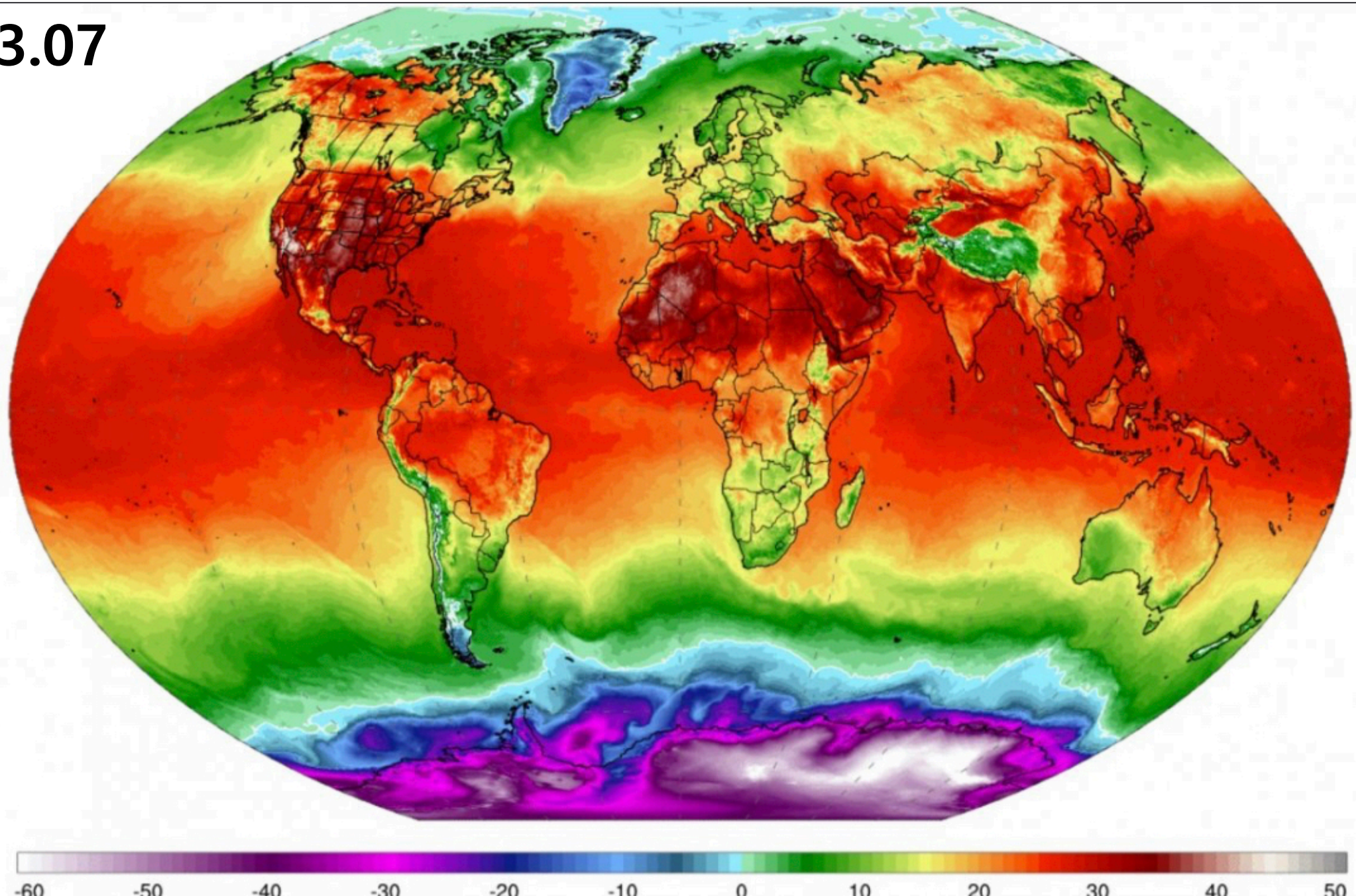
Jung Yul Park, M.D., Ph.D.

Professor of Neurosurgery & Medical Humanities
Korea University College of Medicine

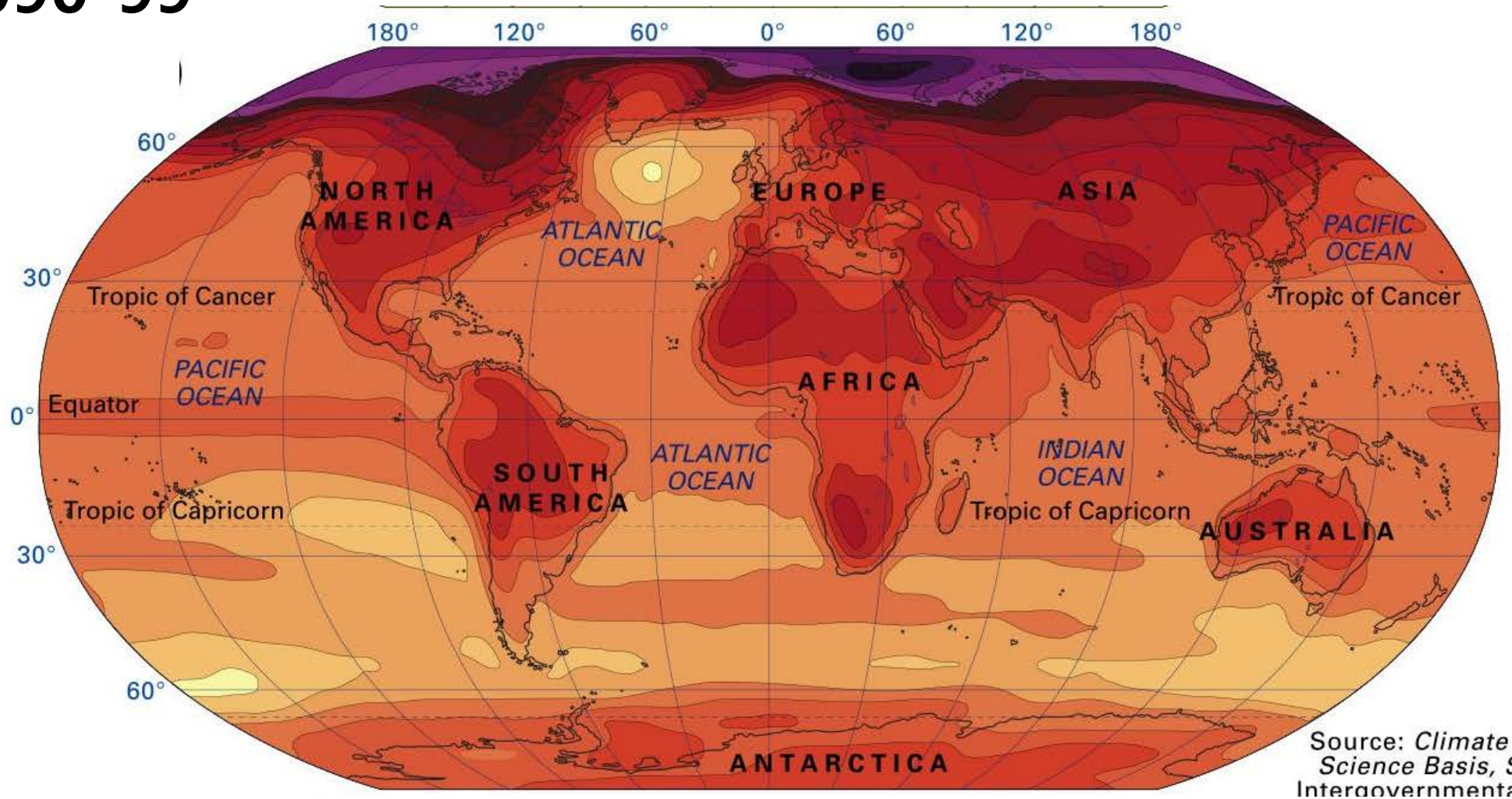
2001


Polar and subpolar zone
Temperate zone
Subtropical zone
Tropical zone
NORTH PACIFIC OCEAN
NORTH ATLANTIC OCEAN
NORTH PACIFIC OCEAN
SOUTH ATLANTIC OCEAN
INDIAN OCEAN
SOUTH PACIFIC OCEAN
SOUTHERN OCEAN
SOUTHERN OCEAN
SOUTHERN OCEAN

2023.07



2090-99



Scale by latitude

60°
30°

0 1000 2000 miles
0 1610 3220 km

Source: *Climate Change 2007: The Physical Science Basis, Summary for Policymakers,* Intergovernmental Panel on Climate Change

Climate Change

- Mean temperature at earth's surface is predicted to **rise at least 2 degrees** Celsius by 2100 and to 5 degrees in next 100 years.

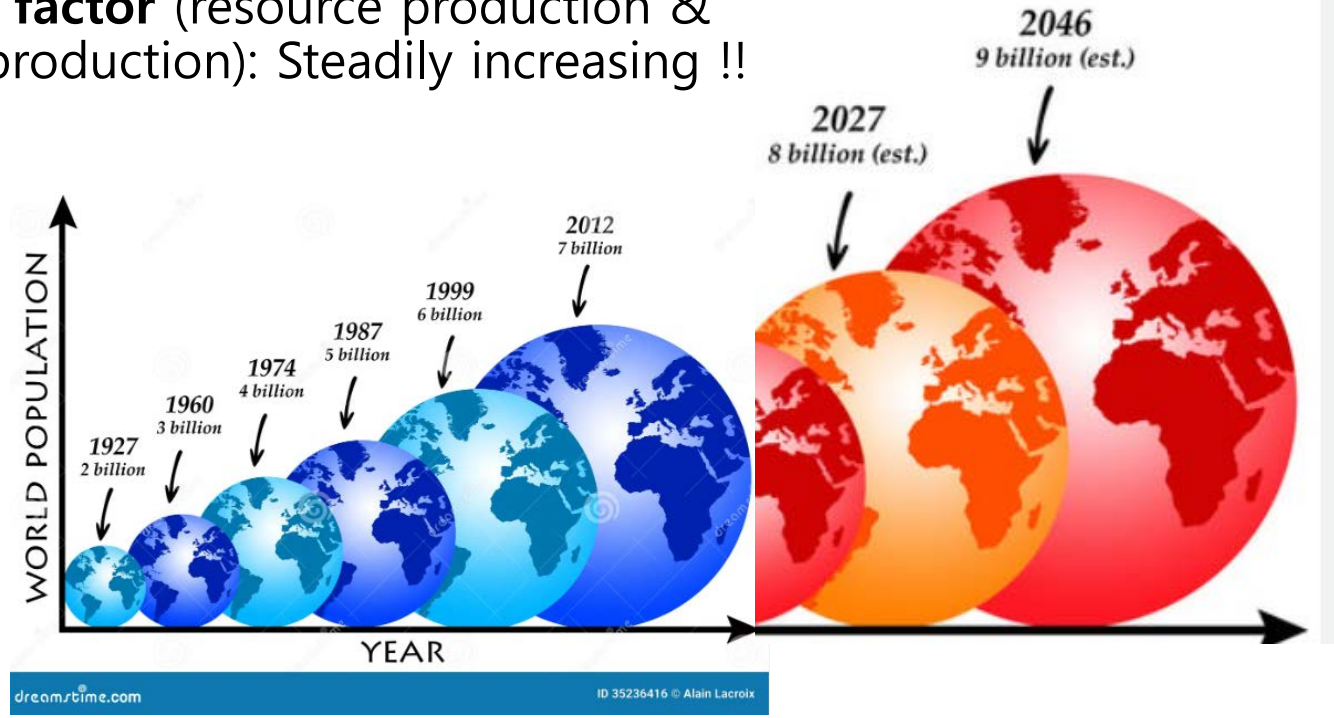
- Ocean may **rise 30-60cm** by 2100, & 1 m in 50-100 years, **even if** greenhouse gas emissions are sharply reduced and global warming is limited to well below 2^0C!

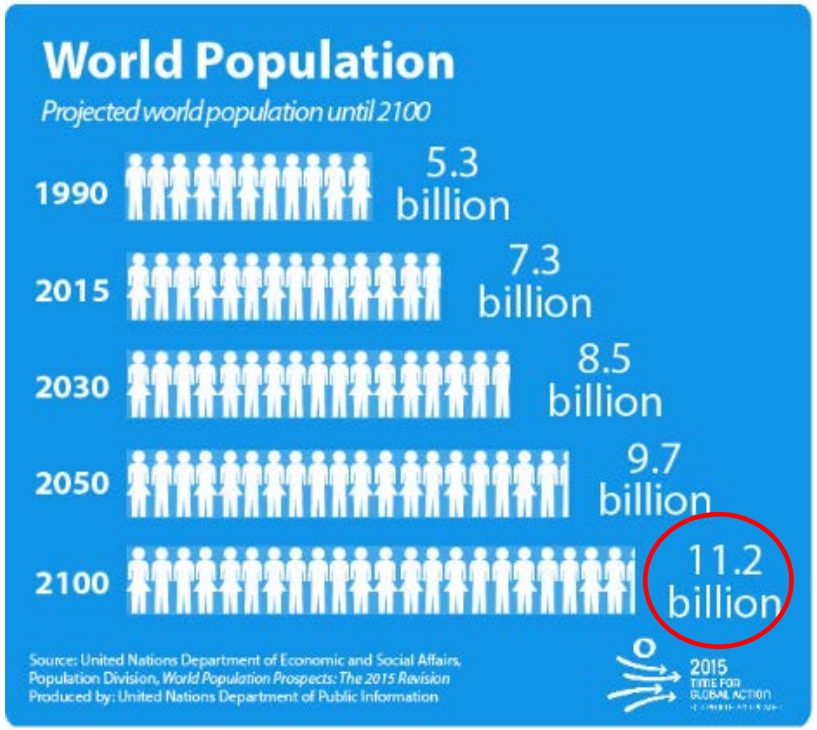
- *"We are the first generation to fell the impacts of climate change and the last generation to do something about it"* **- Barack Obama (2015) -**

The IPCC says sea levels could rise around 30-60 cm by 2100 even if greenhouse gas emissions are sharply reduced and global warming is limited to well below 2°C, but around 60-110 cm if greenhouse gas emissions continue to increase strongly. Photo: "Rising sea levels" by go_greener_oz is licensed under CC BY-ND 2.0

Global Climate Change

- In 2021, the **WHO** declared climate change to be "the **single biggest health threat** facing humanity."
- Complicated and confusing with paradoxes
- Few good effects (opening ice-free shipping lanes in far North as Arctic sea ice melts, increased wheat production, etc), but mostly bad effects.
- Being **caused by** overwhelmingly by human activities.
- **People factor** (resource production & waste production): Steadily increasing !!

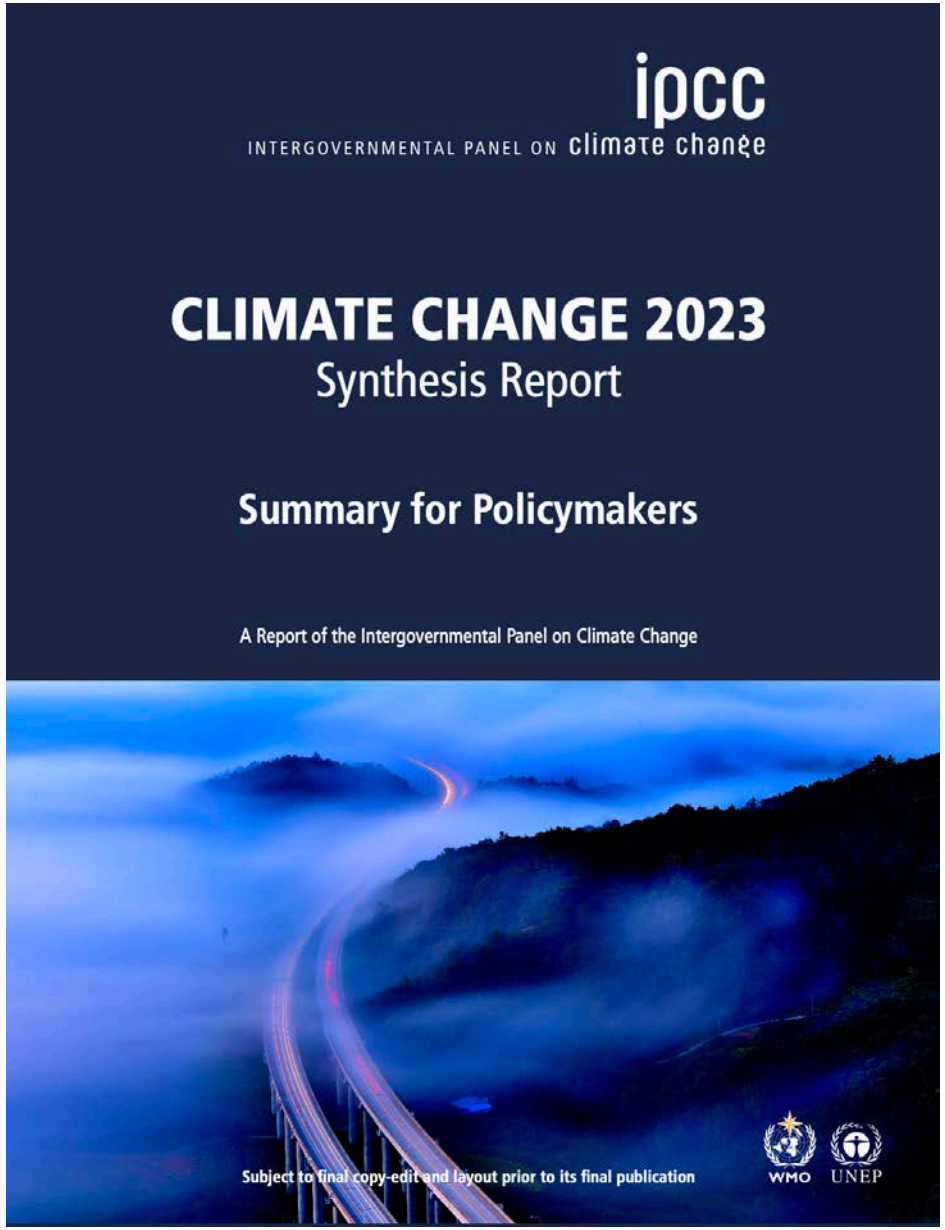




UN warns that the climate's at boiling point Getty Image

End of "Global Warming" Start of era of "Global Boiling"

- **July 2023 is set to be the hottest month ever recorded in human history**
- UN Secretary-General António Guterres said the era of global warming has ended and "the era of global boiling has arrived."
- On the **27th of July 2023,** the Secretary-General, who was speaking at United Nations (UN) headquarters in New York, highlighted **the need for leaders to step up** for climate action and climate justice, particularly those of G20 countries emitting 80 percent of global emissions.
- **The consequences are clear, and they are tragic**: children swept away by monsoon rains; families running from the flames; workers collapsing in scorching heat.



- By mid-century, under a no-action scenario, "the average number of days per year with a heat index above 100°F (37.8 C) will more than double, while the number of days per year above 105°F (40.6C) will quadruple.
- Worldwide, extreme heat **kills at least 300,000 people** each year
- **Sea level** has been rising at roughly 16 inches (40.6cm) per century.
- If carbon emissions are reduced per the nationally determined contributions (NDCs), the probability of limiting the rise in average global temperatures to 2 degrees Celsius by the year 2100 grows to 34% relative to preindustrial levels. (8% in 2015)
- If each country achieves its short-term goal and later sets and implements more ambitious ones, the probability of limiting the global temperature rise to under 2 degrees rises to **60%**, while the possibility of limiting change to under 1.5 degrees grows to **11%**.

Causes of Climate Change

- Natural
- Anthropogenic (human-induced)

Climate change is exacerbating **global inequality**. Researchers have found that the gap between rich and poor countries is now about 25% wider than it would be without climate change.

"The consequences of climate change affect most severely those populations worldwide least responsible for it."
(Marlehn Thieme, President of Welthungerhilfe)

Natural Causes of Climate Change

1. Variation in orbit of the Earth

The reach of sunlight falling on Earth's surface is directly associated with the position of earth on its orbit. Any variation in the orbit of the Earth influences the entire energy budget pattern of the Earth leading to climate change.

2. Volcanic Activities

Gases and dust particles released during volcanic eruptions partially block the incoming solar rays leading to a cooling of weather. While volcanic activities last only for a small span of time, the gases and dust released in huge quantities influence the climatic pattern for a long time. (*asteroid collision)

3. Continental Drift

Continental drifts change the physical features of a landmass including its proximity with water bodies, direction, and strength of winds, the flow of winds, ocean currents, etc. The change in the overall physical feature ends up impacting the climatic pattern of the world.

4. Plate Tectonics

The horizontal and vertical displacements associated with plate tectonics greatly influence climate change over a long time span. The continuously evolving nature of the Earth's surface and redistribution of landmass affects the balances of incoming and outgoing radiation.

Anthropogenic Causes of Climate Change

1. Carbon Emission

Excessive release of CO_2 and other greenhouse gases into the atmosphere :
rapid industrialization, vehicular pollution, transportation, thermal power generation, and commercial-residential. Trapped heat results in an unnatural increase in the temperature of Earth.

2. Burning of Fossil Fuel

The burning of fossil fuels emits a large amount of greenhouse gas. It is considered as one of the main reasons for global warming.

3. Change in Land Use

Complex linkage between land use and climate change. Humans have interfered with the natural pattern of land distribution and diverted a large portion of land for agricultural use. Today, **the total land under agricultural use exceeds the total area under forest**. The shift in the pattern is both directly and indirectly linked to climate change.

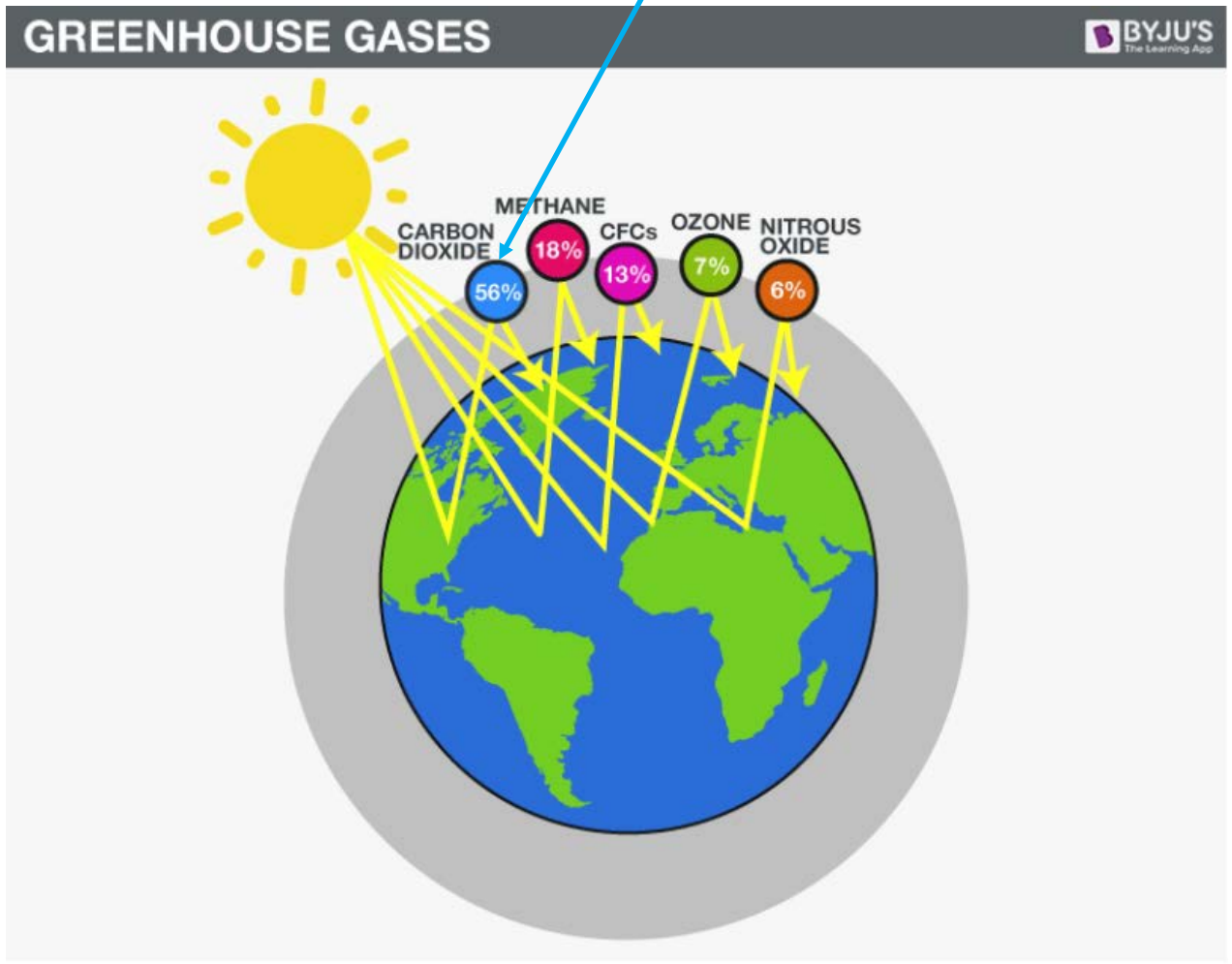
4. Deforestation

It is one of the main human-induced drivers of climate change. It not only removes the vegetation which absorbs the carbon dioxide process from the air, but it also ends up emitting greenhouse gases during the process of removal of a forest.

Greenhouse Gases

- Life on earth depends on energy from the sun. About ½ of light energy reach earth's atmosphere passes through air and clouds to the surface where it is absorbed and radiated in the form of infrared heat
- Nearly 90% of this heat is then absorbed by greenhouse gases and re-radiated, slowing heat loss to space.
- GHGs include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), chlorofluorocarbons (CFCs), ozone (O_3), and water vapor (H_2O).
- The planet's average surface temperature has risen about 2.12° Fahrenheit (1.18° Celsius) since the late 19th century (Industrial revolution) due to increased human activities (i.g, burning fossil fules) and the clearing of land for agriculture.

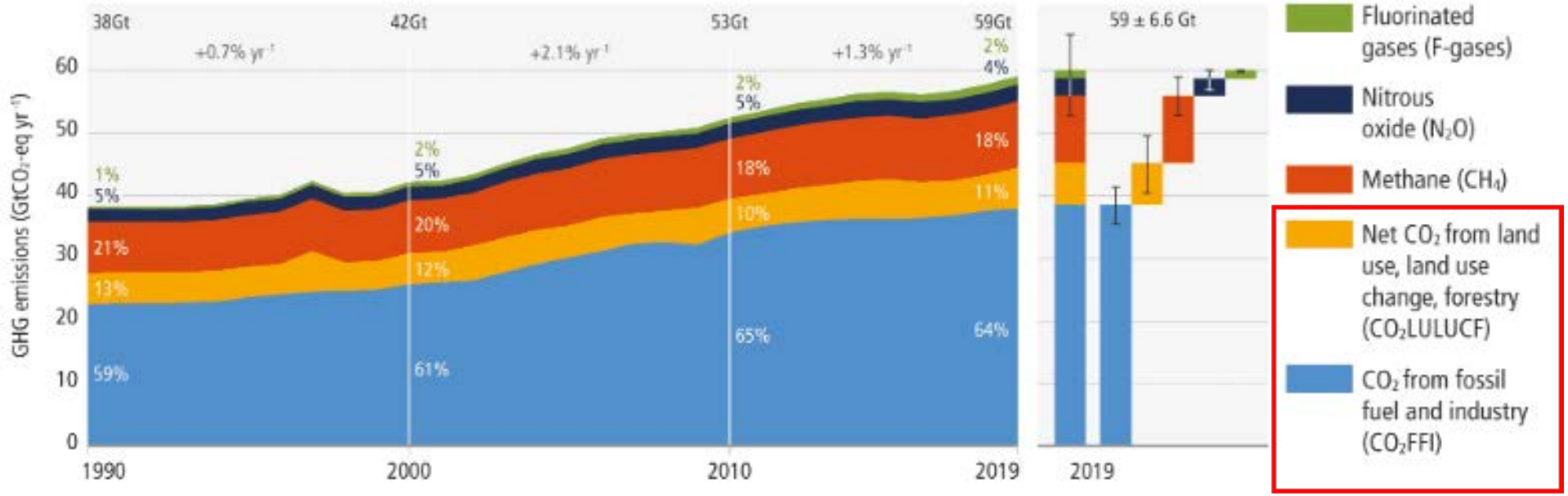
Primary source for Greenhouse Effect



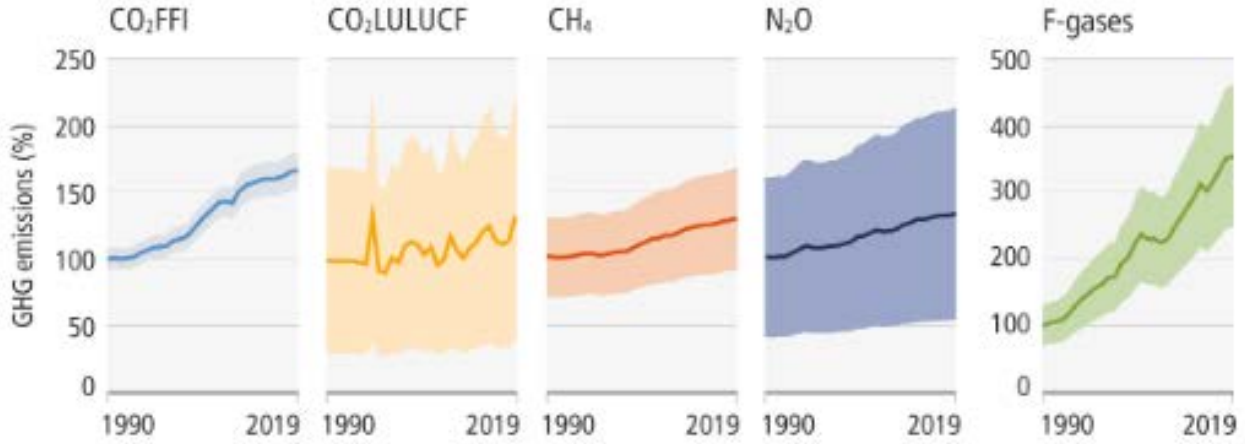
The Diagram shows Greenhouse Gases such as carbon dioxide are the primary cause for the Greenhouse Effect

Global net anthropogenic emissions have continued to rise across all major groups of greenhouse gases.

a. Global net anthropogenic GHG emissions 1990–2019 [5]



b. Global anthropogenic GHG emissions and uncertainties by gas – relative to 1990

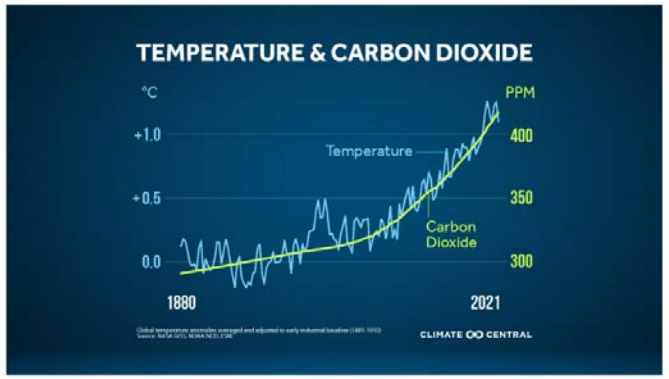


	2019 emissions ($GtCO_2$-eq)	1990–2019 increase ($GtCO_2$-eq)	Emissions in 2019, relative to 1990 (%)
CO_2 FFI	38±3	15	167
CO_2 LULUCF	6.6±4.6	1.6	133
CH_4	11±3.2	2.4	129
N_2O	2.7±1.6	0.65	133
F-gases	1.4±0.41	0.97	354
Total	59±6.6	21	154

The solid line indicates central estimate of emissions trends. The shaded area indicates the uncertainty range.

Global temperature variations over last 2022 years

(using information derived from tree rings and other 'proxies')



WE ARE HERE

410ppm

1°C

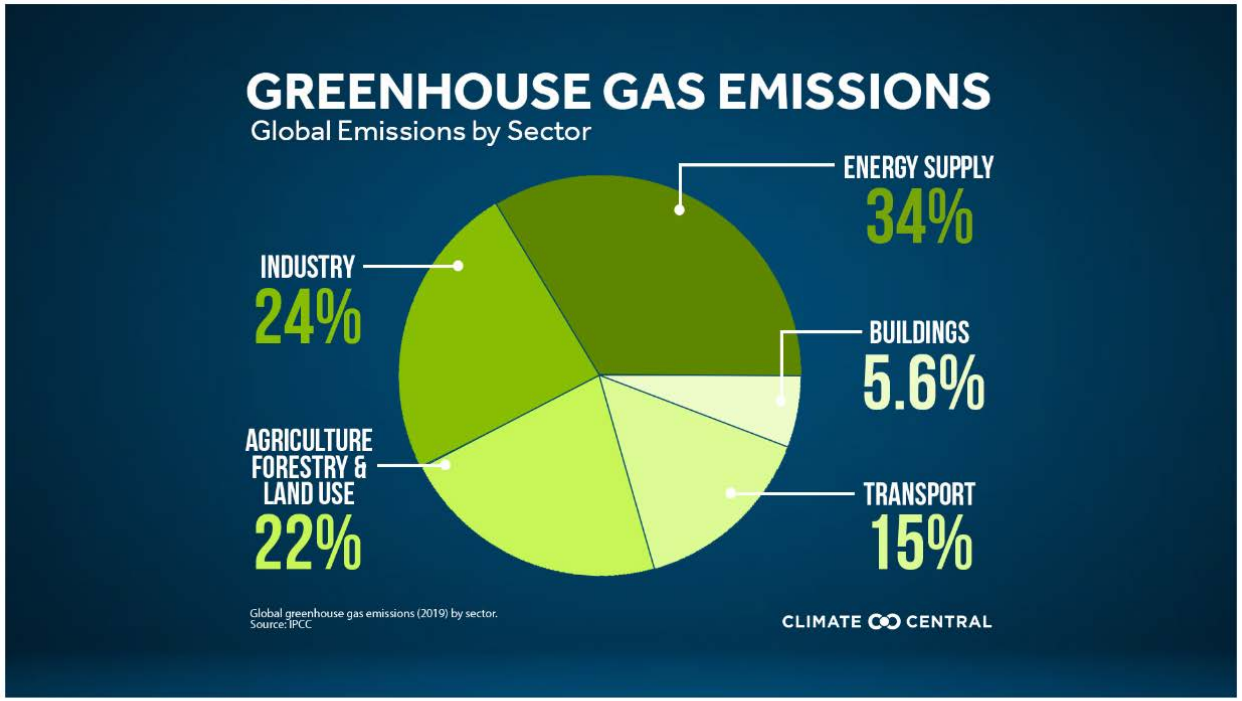
Carbon dioxide levels

280ppm

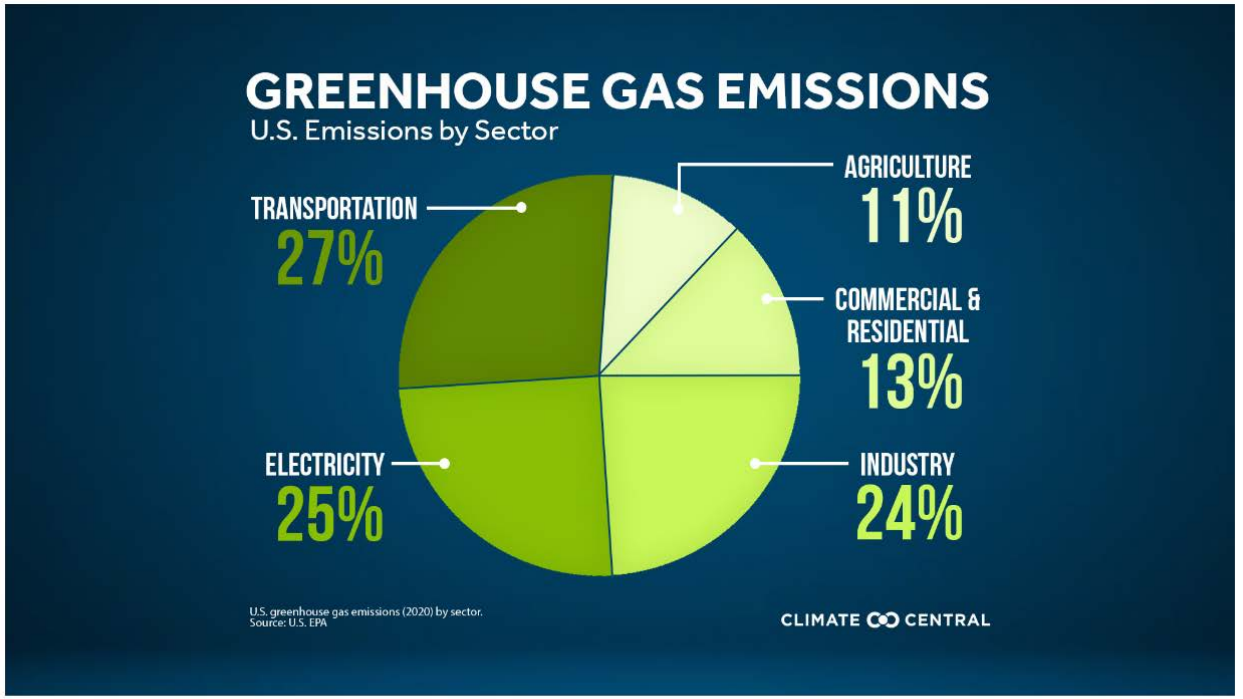
Invention of steam engine

Graphic: @ed_hawkins
Data: PAGES2k (years 1-2000) and HadCRUT5.0 (2001-2022)
Reference period: 1901-2000

Greenhouse Gas Emissions by Sector



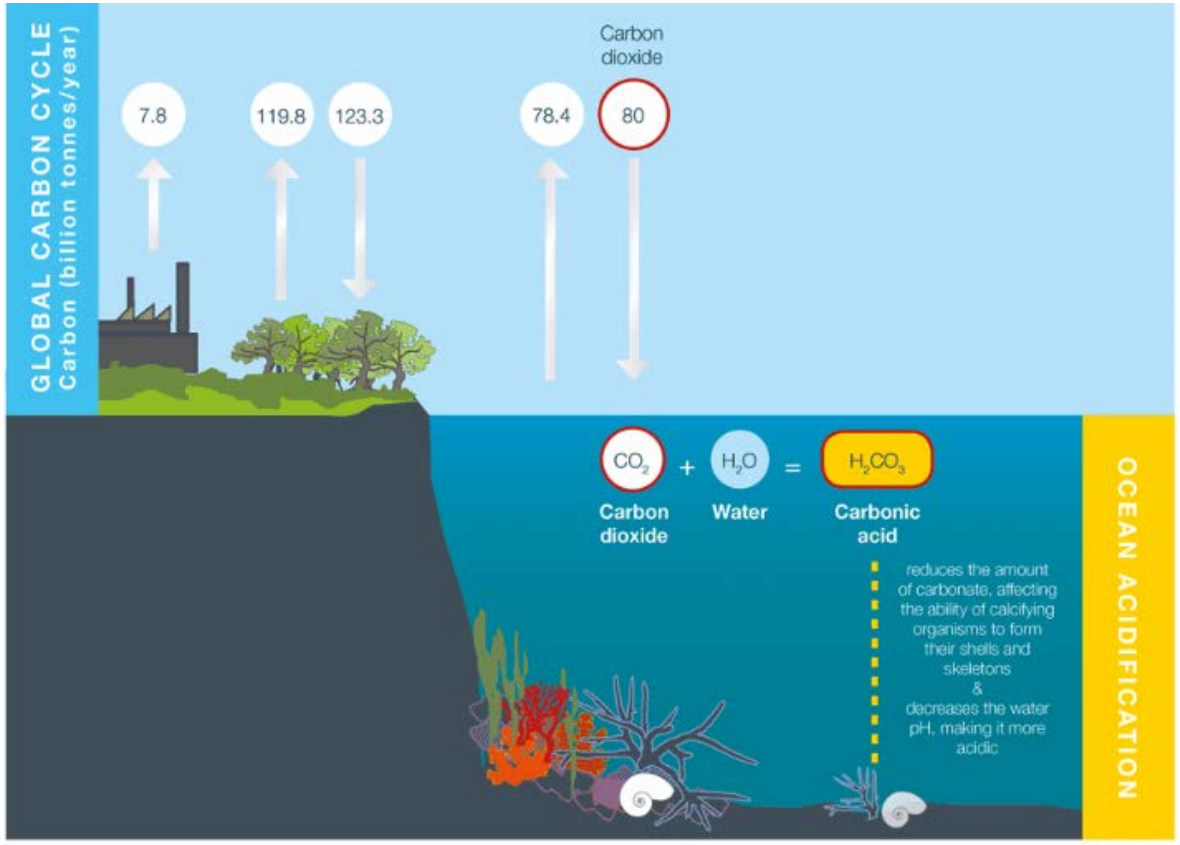
Global Emissions by Sector (2019)



U.S. Emissions by Sector (2020)

CLIMATE CENTRAL

Ocean Acidification by Climate Change



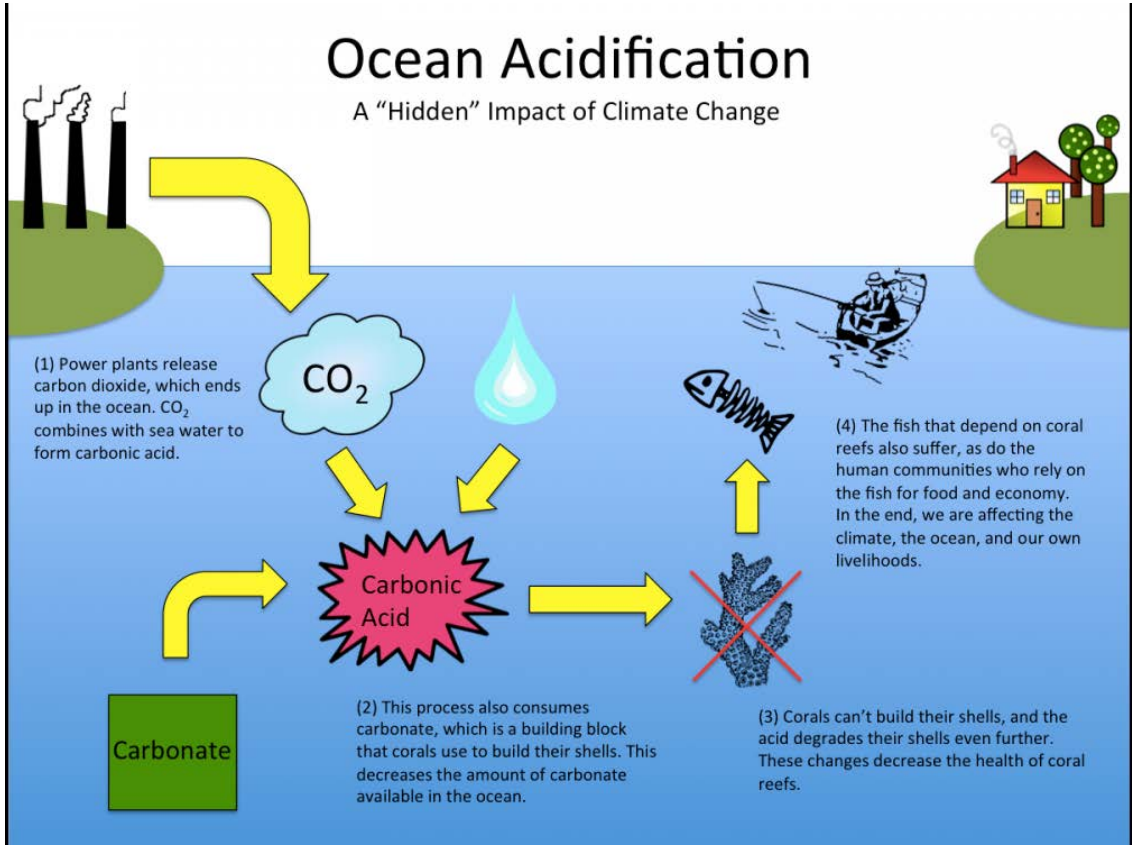
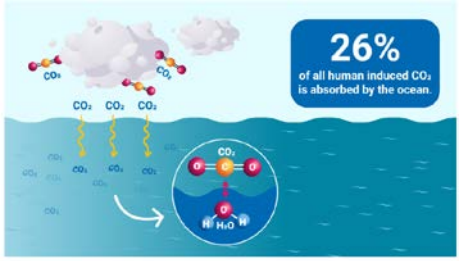


Figure 1: Some of the carbon dioxide emitted to the atmosphere by human activities is absorbed by the oceans. When carbon dioxide combines with water in the ocean it forms carbonic acid, which makes the ocean more acidic and may reduce the ability of calcifying organisms to form their shells and skeletons. Source: Adapted from J. Cook, skepticalscience.com.



(Graphic: A. Vargas Terrones /IAFA)

Shape of Life

CLIMATE CHANGE = OCEAN CHANGE

Effects of Climate Change

The global average temperature of Earth is expected to rise from 2-degree to 11.5-degree Fahrenheit over the next century

1. Melting of Glaciers

Melting of glaciers is probably **one of the strongest indicators of global warming and climate change**. The size, spread, and balance of glaciers present some crucial information on climate. With the constant increase in temperature, glaciers have started to retreat at a very fast pace. This has eventually led to a noteworthy **rise in the sea level.** Any further significant rise in the sea level may devastate some coastal and island regions on the planet.

Meltwater brings a lot of changes to the coast when glaciers and ice sheets dwindle. Photo by Colin Monteath/Minden Pictures

2. Rising Sea-Level

A sharp rise in sea level has been observed in the past two decades. It can be well understood from the facts that **between 1870 to 2004, the sea level increased by 195 mm in total**. On the other hand, it took an alarming sharp rise of **43 mm** between 2004 until the present times.

3. Natural Disasters

Increase in the average surface temperature of Earth has increased the relative possibility of natural disasters like **storms, drought**, etc. A rise in temperature triggers more water evaporation, thereby increasing the likelihood of stronger and more devastating storms. Similarly, changes in seasonal and annual precipitation as a result of climate change has increased the odds of worsening droughts.

Coral reef islands are losing the battle with sea-level rise, as exemplified by Beneamina, Solomon Islands, in the Pacific Ocean. Photo by Simon Albert.

4. Impact on Vegetation

Climate change may vary the type and distribution of vegetation.

Any rise in the temperature may lead to early blooming and fruiting of plants.

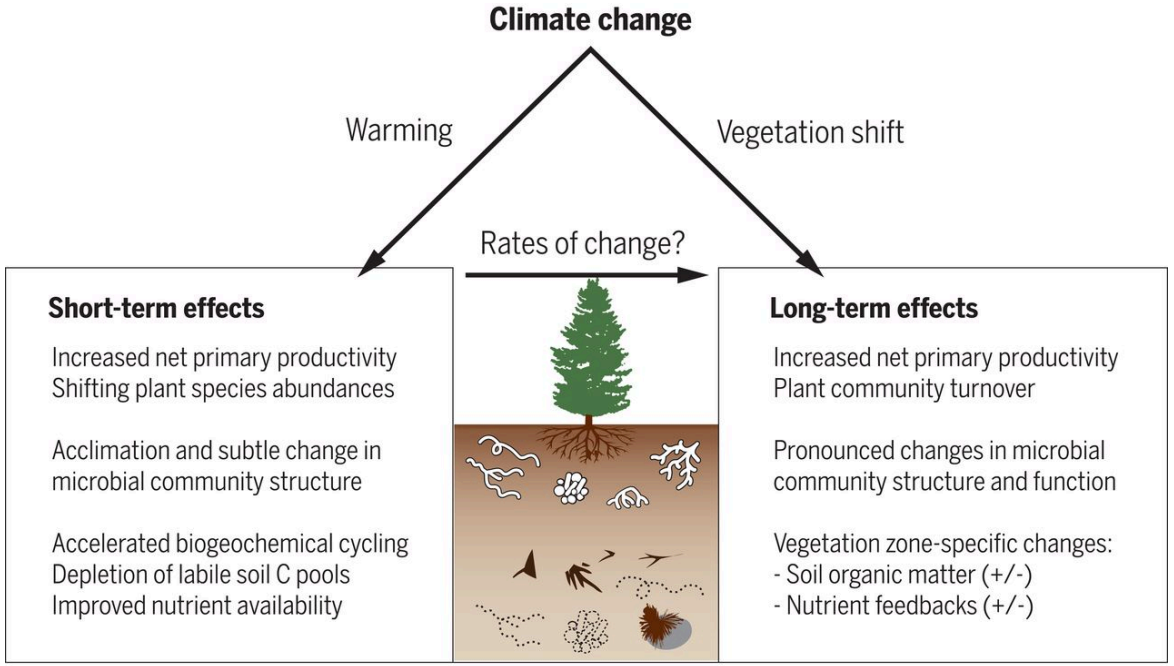
This, in turn, may end up resulting in significant changes in the life pattern and cycle of living organisms.

5. Disturbed Food-web

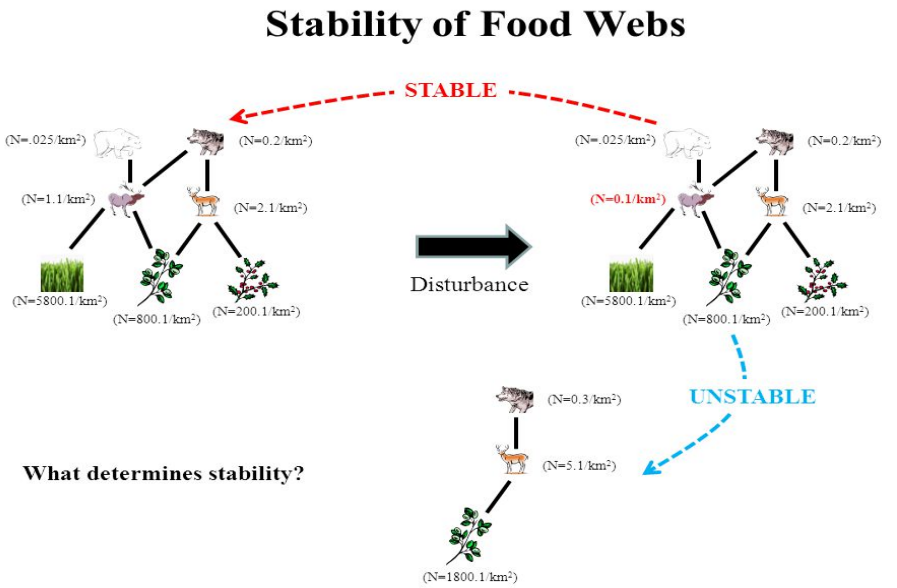
Changes in the climate lead to changes in the **food web** of living organisms.

Species will have to keep up its pace with the rapidly changing climatic conditions.

Relative abundance or scarcity at any level can have devastating consequences for the entire food web.



SCIENCE 13 Sep 2019 Vol 365, Issue 6458 pp. 1119-1123 DOI: 10.1126/science.aax4737

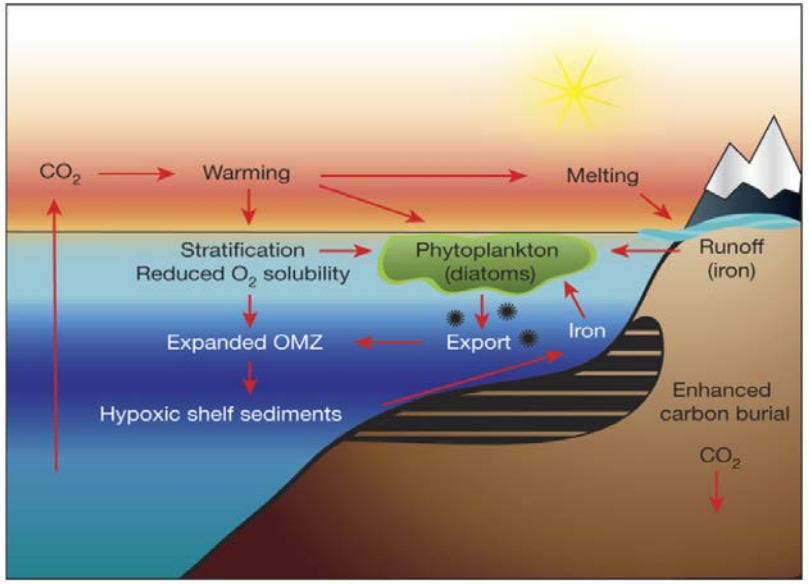


6. Warming of Oceans

Excessive heat as a result of greenhouse gas emissions is mostly absorbed by the oceans.

This absorption raises the temperature of the oceans in turn.

Warming of the oceans triggers devastating storm and excessive rainfall leading to flooding.



Schematic diagram of feedback processes linking ocean warming to enhanced export productivity. As CO2 is vented from the deep ocean throughout the deglaciation, the ocean warms along with the climate. Warming reduces oxygen solubility and promotes stratification, leading to an expansion of the OMZ and a greater area of suboxic sediments in the shallow subsurface, which remobilizes bioavailable iron to fuel marine productivity, further depleting subsurface oxygen concentrations as organic matter is exported and respired at depth. The availability of iron and warm, stratified conditions favours large diatoms27, which have high export efficier

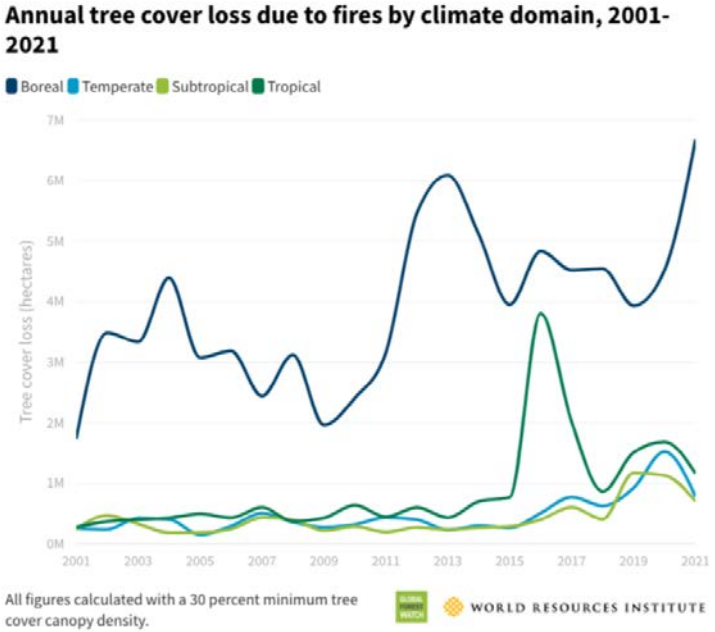
(Alan C. Mix)

7. Climate Change & Wildfires

Recent years have witnessed an unprecedented number of wildfires worldwide.

Climate change has affected the weather and climatic conditions all across the globe.

Factors like constantly rising temperature, change in rain and snow patterns and shifts in plant communities have all increased the risk of frequent wildfires.



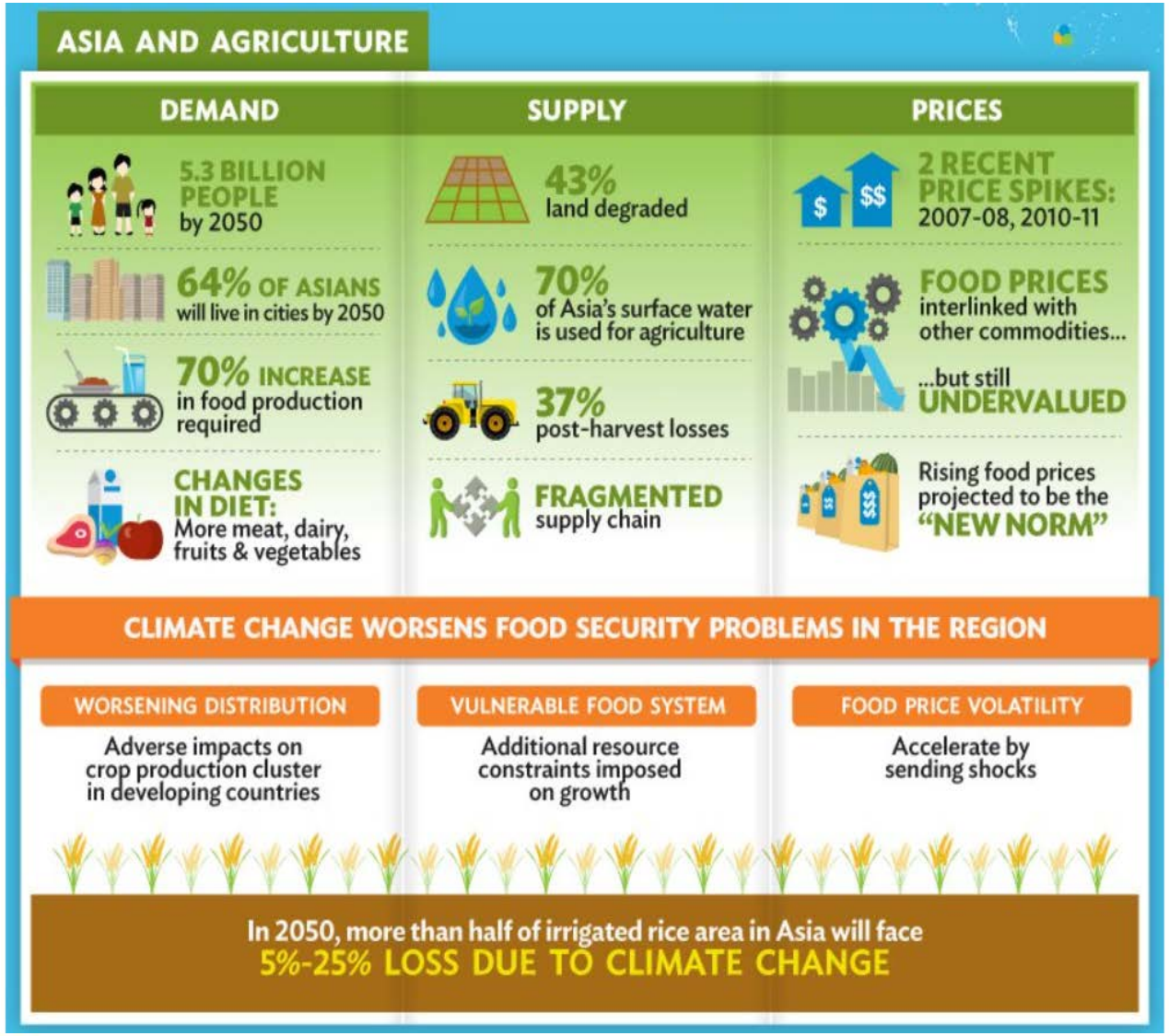
8. Food Security Issues

Over a period of time, climate change has drastically impacted the food security of regions.

It affects the entire food production process thereby limiting the food access.

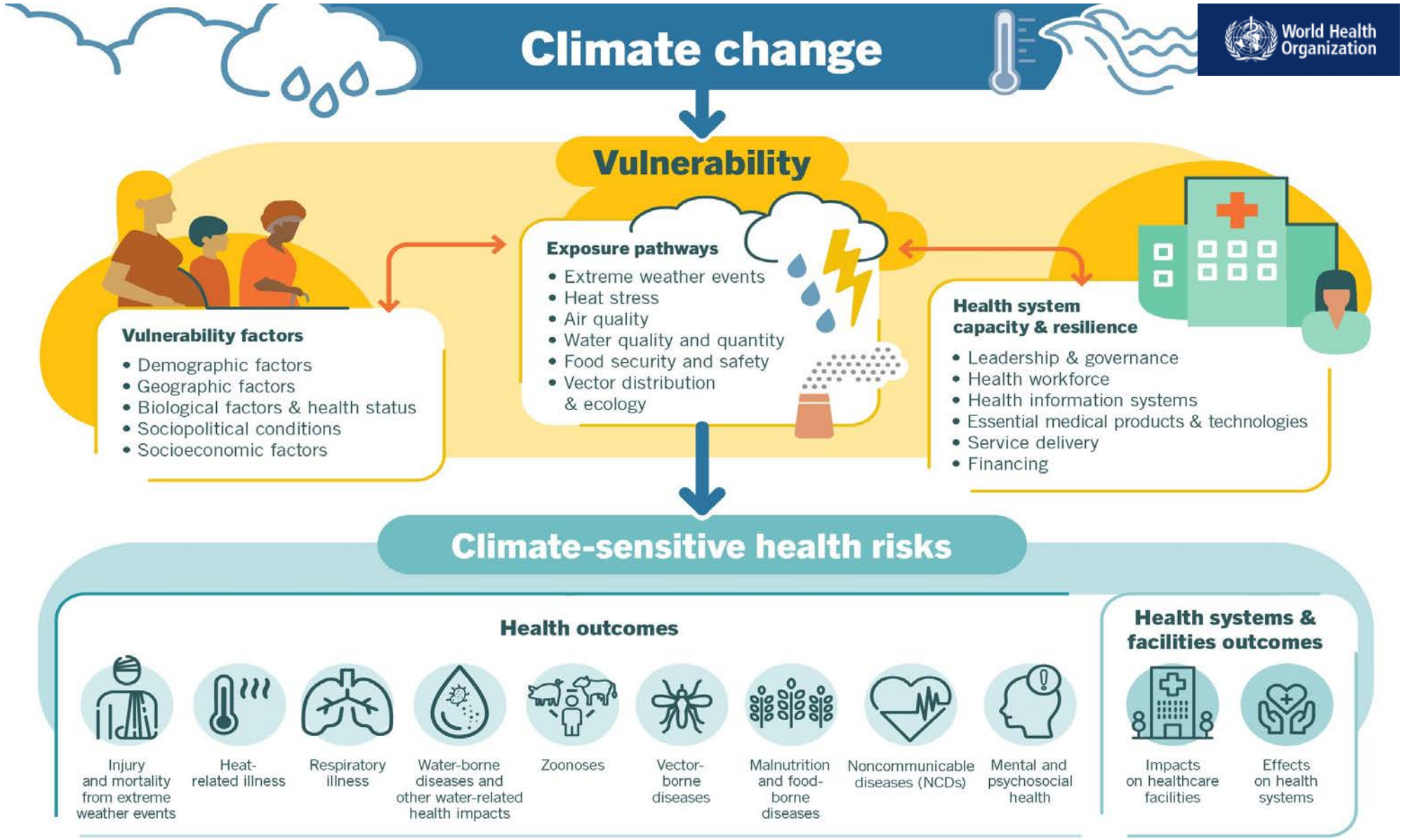
Climate change impacts and weather disasters **inflate the food price** of the available food. Such a price rise disproportionately affects the most vulnerable sections of society.

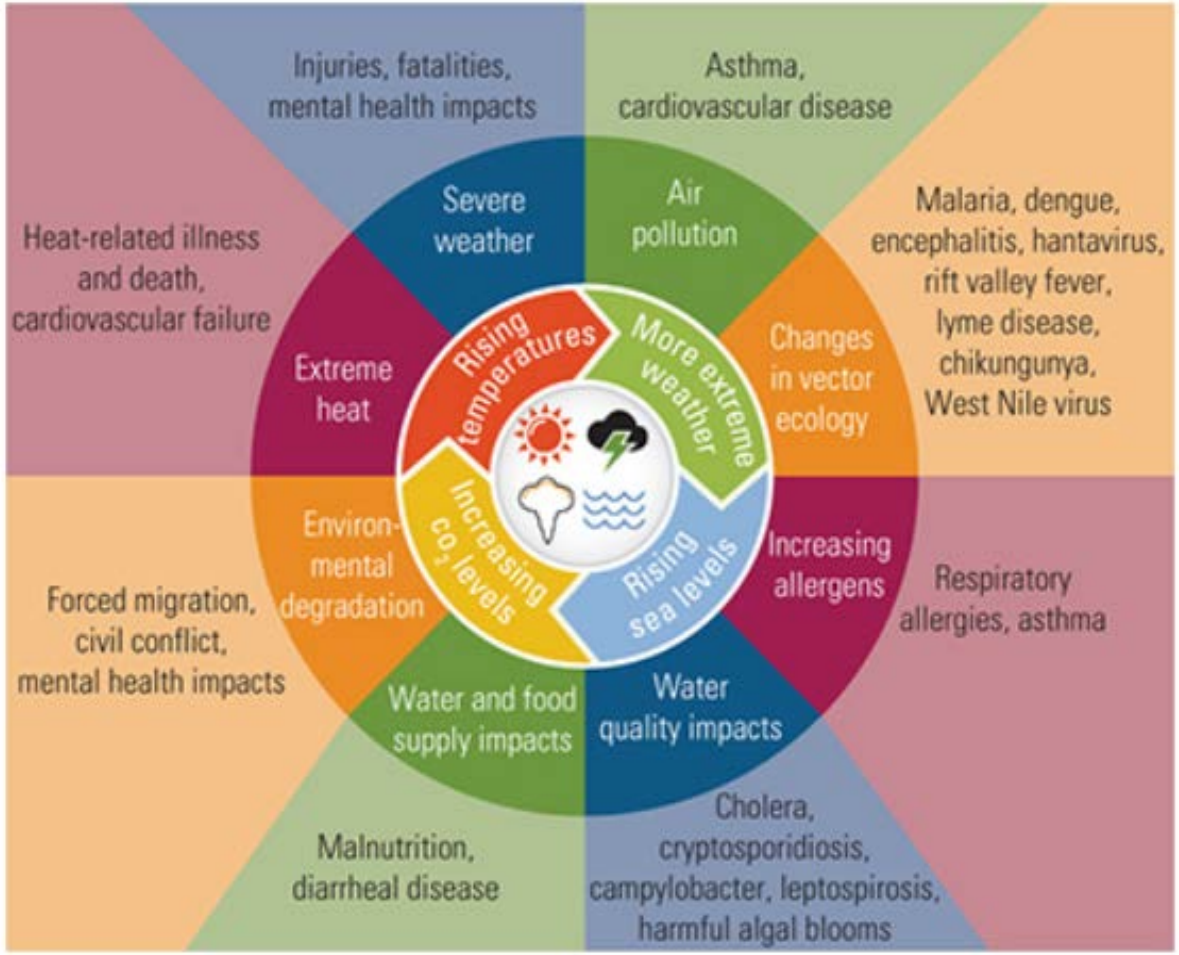
Other risks include a decrease in the nutritional value of food and food waste due to unfavorable conditions.



ADB ASIAN DEVELOPMENT BANK

9. Health Risk





(Graphic: NCBI)

Change in patterns of diseases, variants & **Alteration of geographical distribution** of disease and change in susceptibility to different illness.
Underestimated mental health problems.
Unpredicted, unexpected problems!

95000 deaths per year expected between 2030 and 2050. due to childhood under nutrition.

Deaths from cardiovascular and respiratory disease, particularly among elderly people. [38 000 deaths per year expected due to heat exposure in elderly people between 2030 and 2050]

Between 2030 and 2050, 250 000 additional deaths per year, expected from malnutrition, malaria, diarrhea and heat stress.

- Childbearing women exposed to extreme heat may be at risk of neural tube and other birth defects.
- Currently, **30%** of world population is exposed to potentially destructive heat for 20 days per year.
- Without major depletion in emission of greenhouse gases, **up to 3 in 4 people** will face the threat of death from the heat by 2100.
- Unfortunately, by the end of the century, even if we reduce carbon emission now, **1 in 2 people** will suffer from ultra heat for at least 20 days, which can kill people.

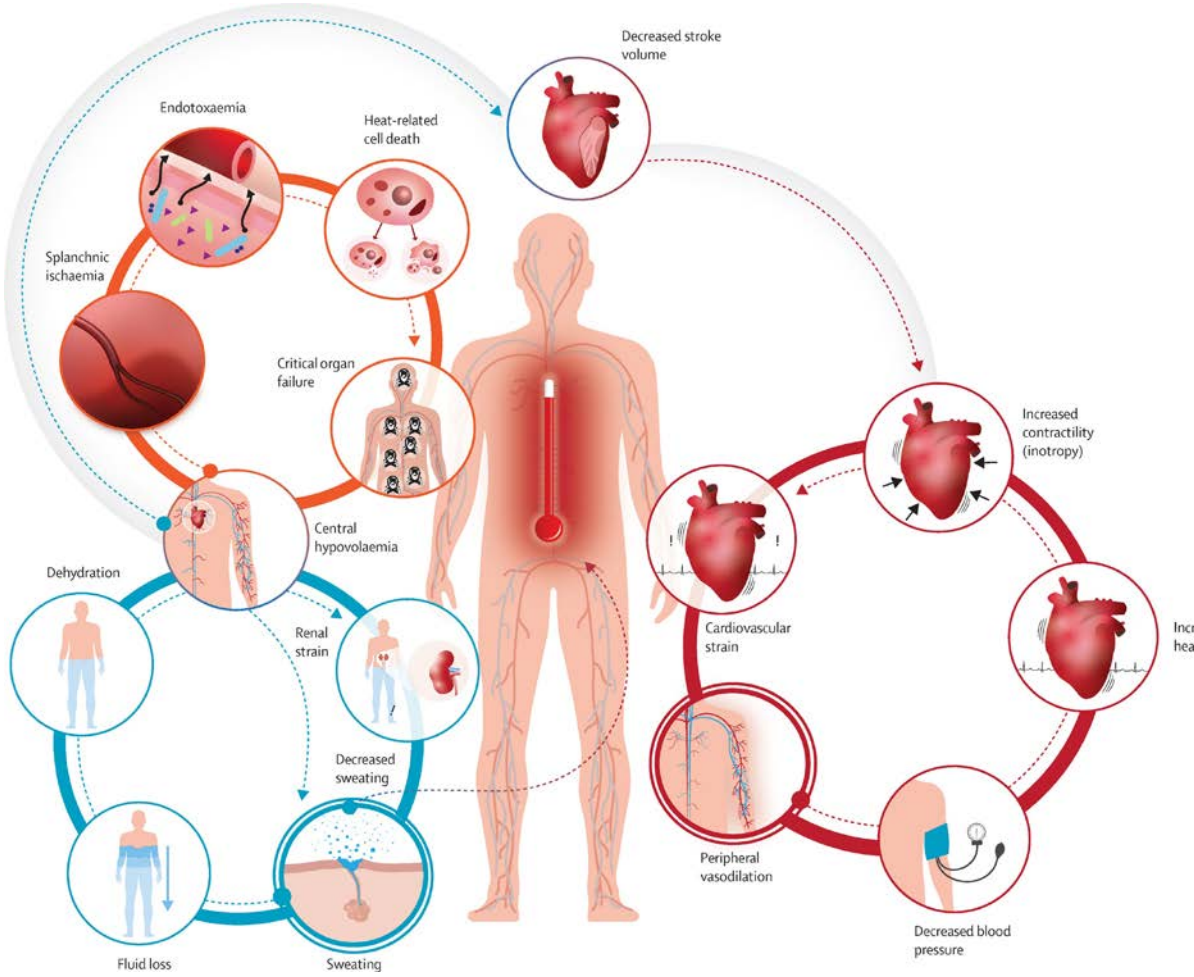


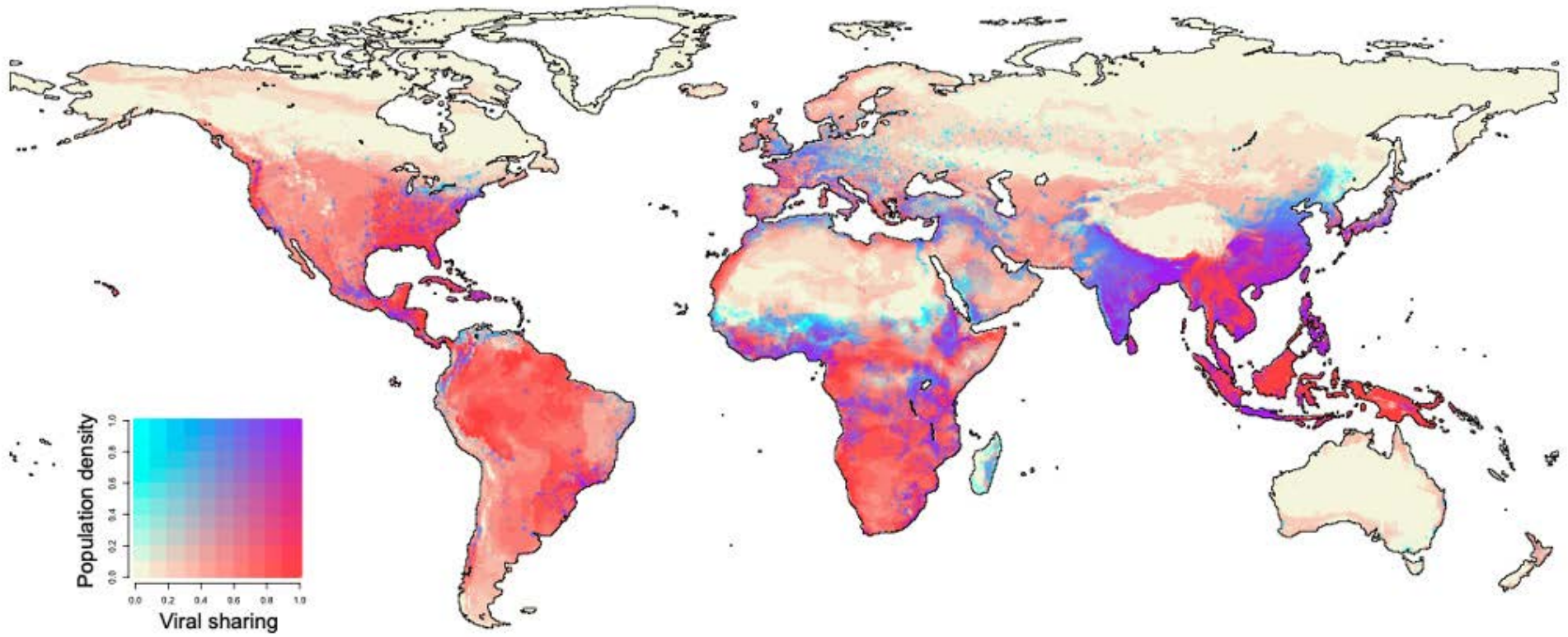
Figure Illustration of the physiological pathways of human heat strain (Lancet, August,2021)

Climate Change: WHO is at risk?

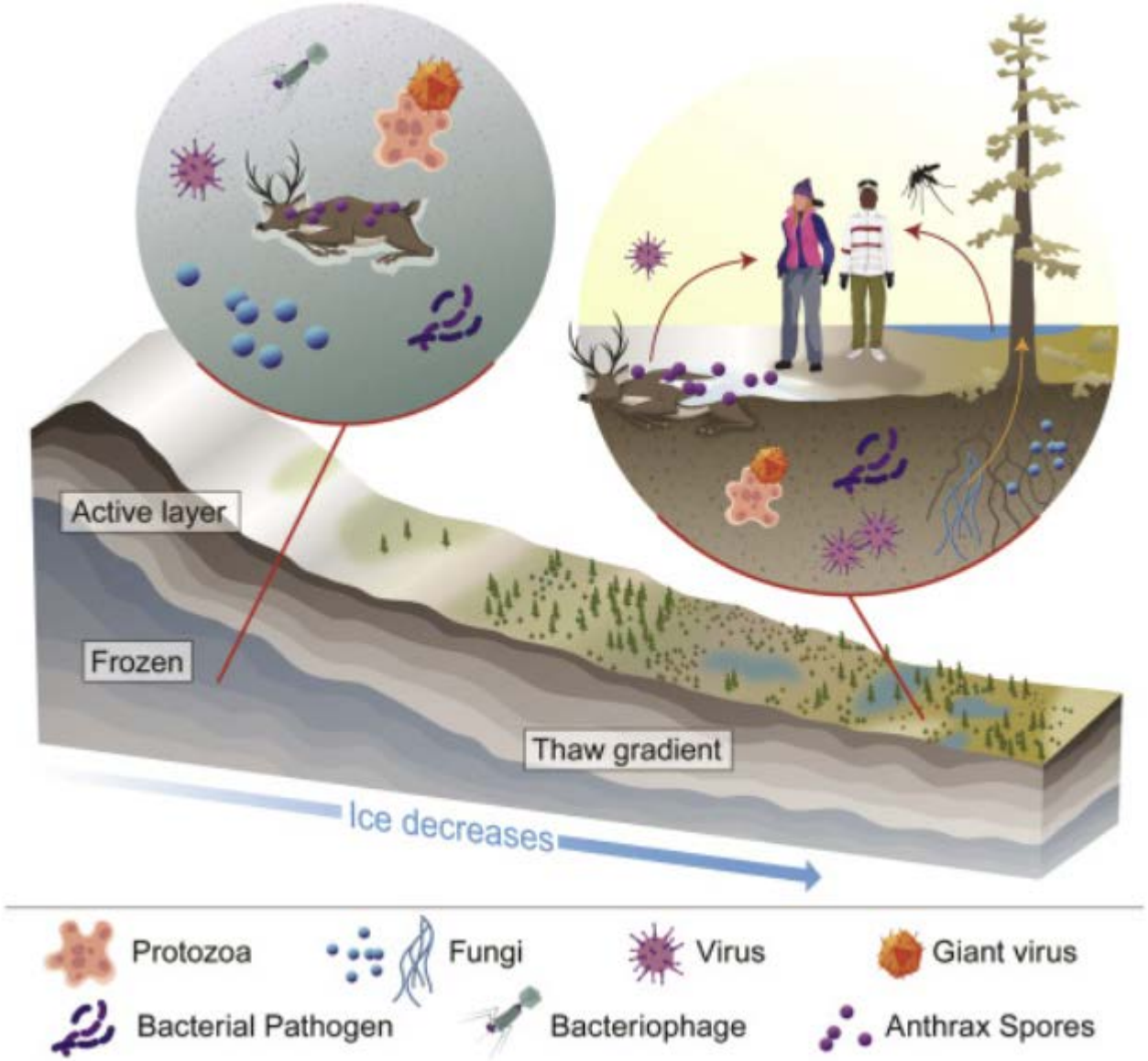
- A lack of safe water can increase the risk of **diarrheal disease,** which kills more than 500,000 children aged under 5 years, every year.
- **Diarrhea** from lack of access to clean water supply, sanitation, and poor hygiene. 1.8 million deaths
- Rising temperatures and variable precipitation **malnutrition** which causes 3.1 million deaths every year.
- About 800,000 people die from urban **air pollution**.
- **Malaria** kills over 400,000 people every year- mainly African children under 5 years old.
- **Another 1 degree increase** : 2.2 billion people in the Indus River Valley in Pakistan and India, 1 billion people in eastern China, and 800 million people in sub-Saharan Africa will experience **heat exceeding human limits** each year. In total, there are about 4 billion people, or close to half of the world's population

Virus Sharing and Population Density (Temp 2^0 C rise)

Expected 15,000 new virus sharing in 3000 mammals



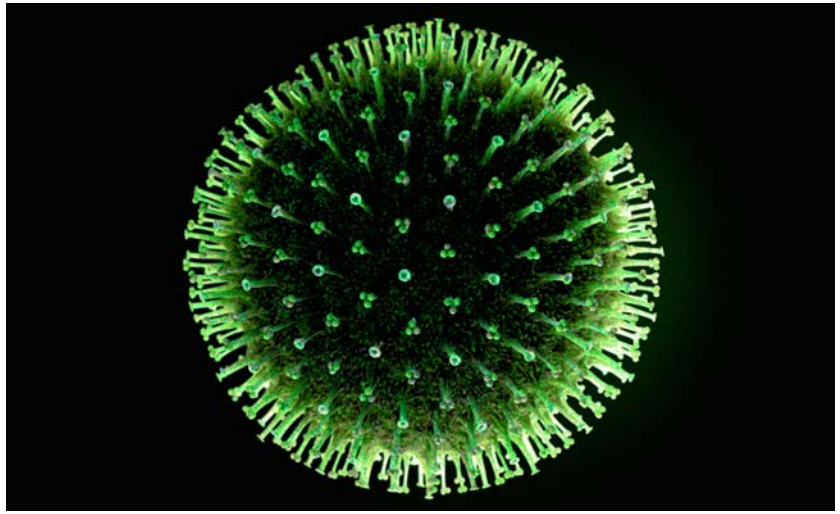
Carlson, C.J., Albery, G.F., Merow, C. et al. Climate change increases cross-species viral transmission risk. **Nature 607**, 555–562 (2022).



Permafrost as a potential pathogen reservoir as well as methane

One Earth: Volume 5, Issue 4, 15 April 2022, Pages 351-360

Viruses in permafrost: Scientists have revived a 'zombie' virus that spent 48,500 years frozen



Giant virus in permafrost: Ian Cuming—Getty Images/Ikon Images (Science)

What Needs to be DONE

- Strengthen & support the public health systems
- Choose healthy paths to a low-to-zero caron future
- Mobilize the strength of the health community
- Advocacy for interdisciplinary and intersectoral partnerships
- Development of abundant, affordable, dispatchable clean energy

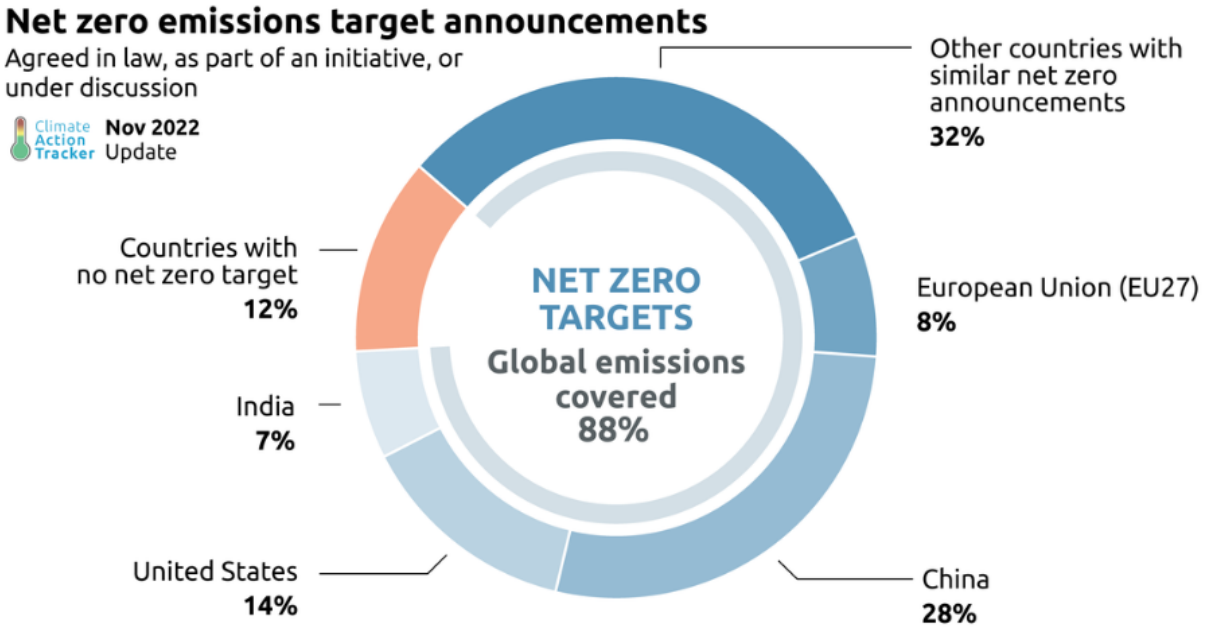
- **Lifelong education & healthcare professional training**
- Prepare for & expeditious measures in case of disaster
- Enhance urban planning: green space, green and SMART city
- Increase price on GHG & penalties for violations of law regarding environment protection according to income status of industry/company

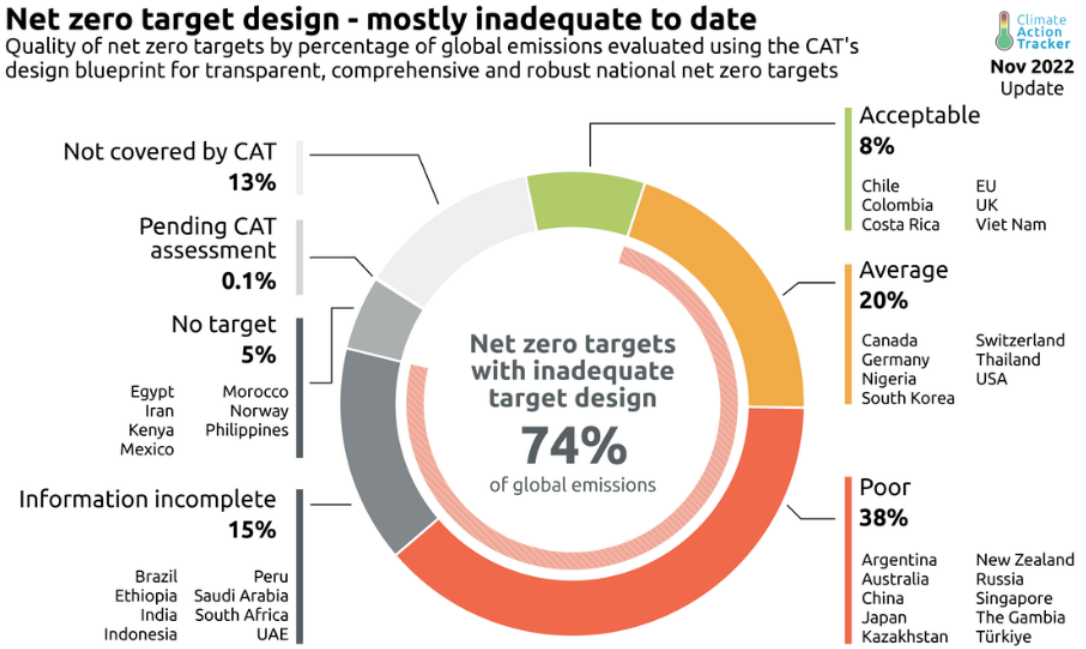
How can each of us tackle climate change?

- Save energy at home. ...
- Change your home's source of energy. ...
- Walk, bike or take public transport. ...
- Switch to an electric vehicle. ...
- Consider your travel. ...
- Reduce, reuse, repair and recycle. ...
- Eat more vegetables. ...
- Throw away less food.
- Plant a tree
- Adjust your thermostat. ...

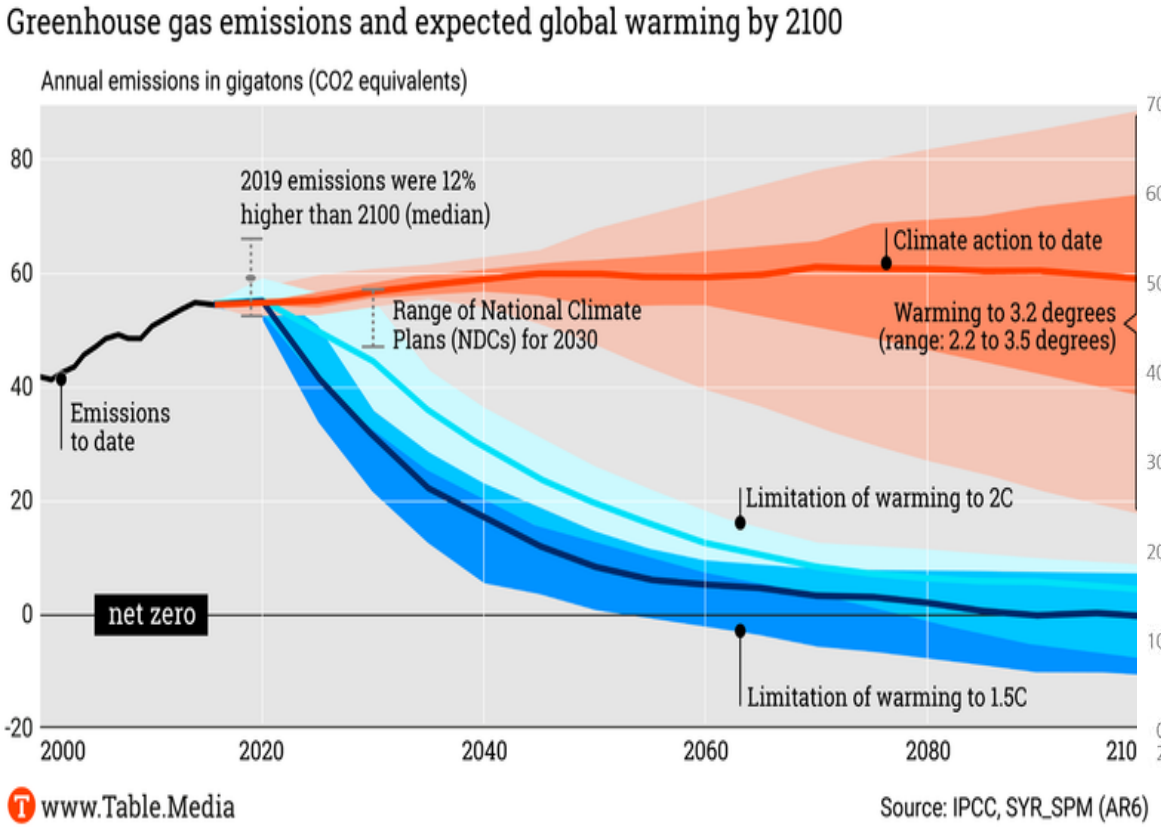
- Purchase renewable energy
- Change a light bulb
- Drive less. ...
- Recycle more. ...
- Check your tires. ...
- Use less hot water. ...
- Avoid products with a lot of packaging. ...
- Pull the plug(s)
- Others...delete SPAM mails !

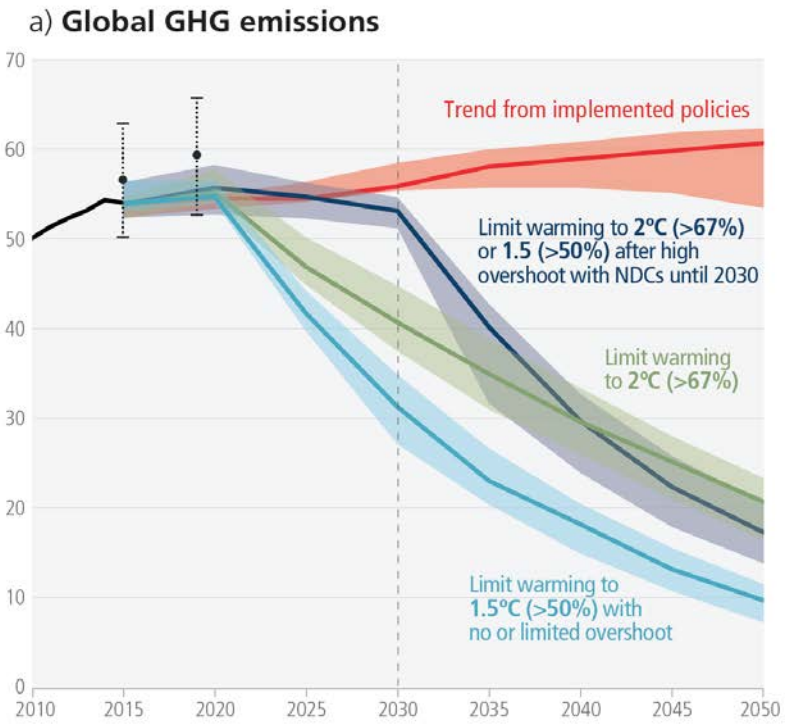
Net Zero Emissions Target

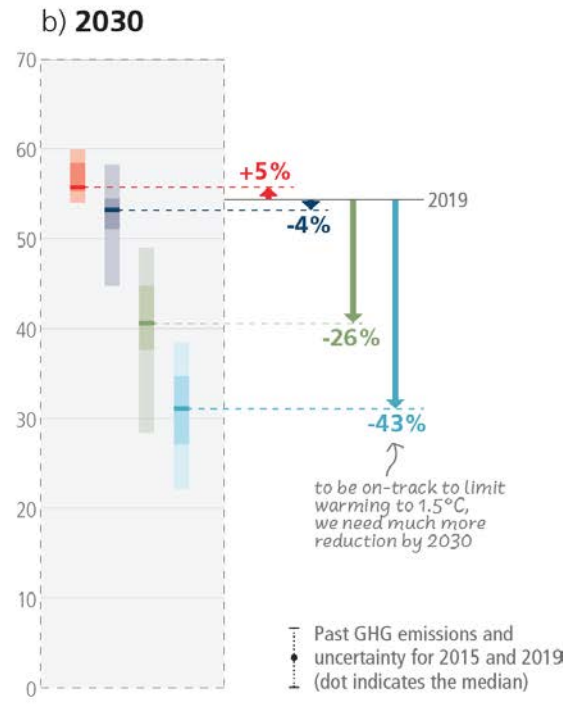




How fast CO2 emissions have to fall







(2023)

Pivotal Roles of Physicians for Climate Change

- Protecting patients from climate related conditions/diseases at clinical as well as actual/remote sites
- Take initiatives & lead by personal example in fight against climate change personally and collectively
- Active participating and supporting for climate related policies and action plans from global/regional healthcare organizations and government/NGOs
- Collaborating and cooperating internationally
- Strong advocators for climate change campaigns
- **Learning/sharing knowledge/information with global networking**
- **Continuous Professional Development (CPD) on climate change**
- Research & Professional Development & Fostering and educating for specialists
- Contribute to a healthier and more resilient future for their patients and communities

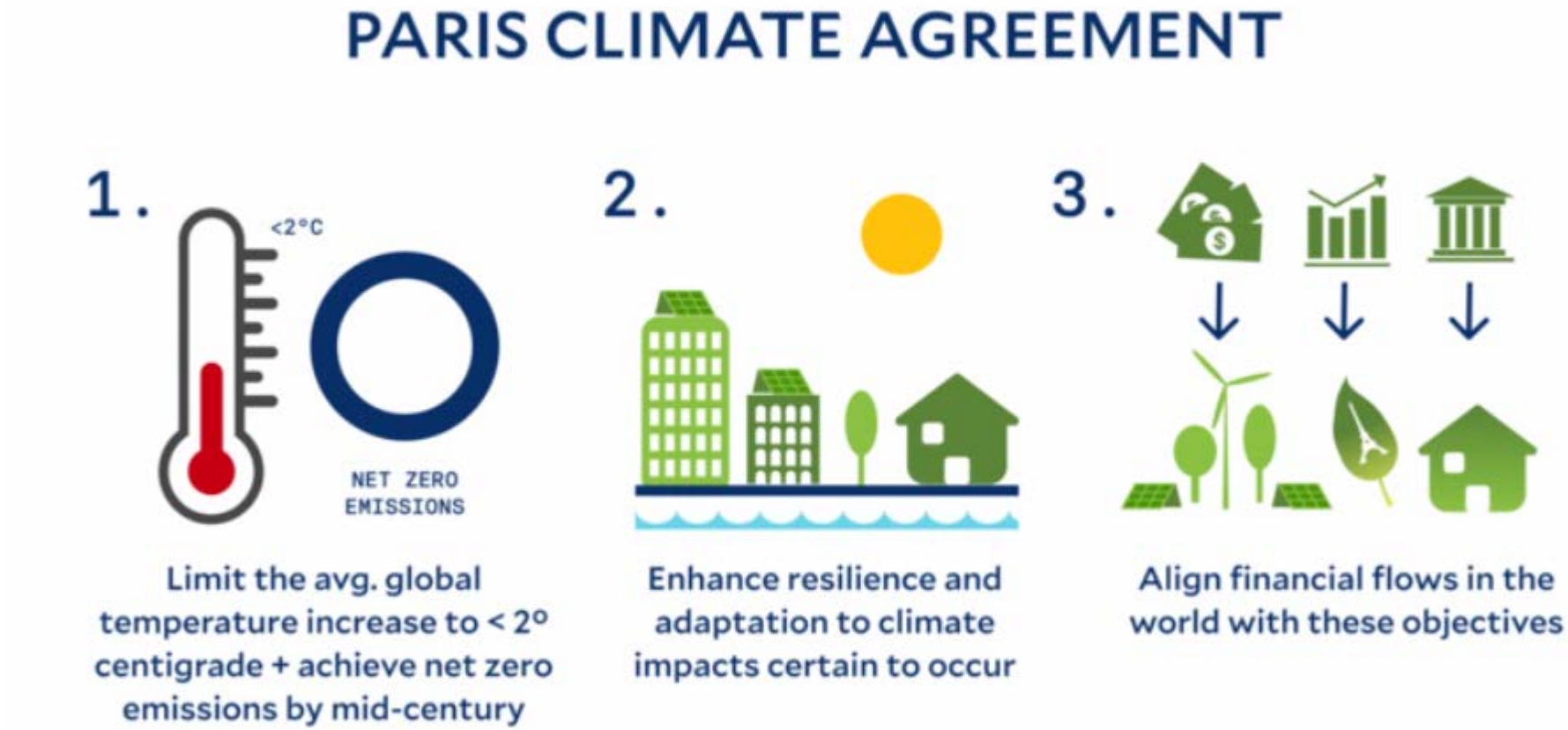
http://www.sustainablebusiness.com/imageupload/doctors.jpg

Global organizations had undertaken to fight against climate change and its impact on health.

International Climate Change Organizations

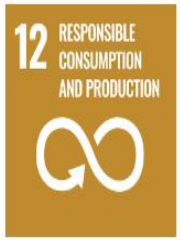
World Meteorological Organization (WMO)
Intergovernmental [Panel on Climate Chang
350.org
The Global Environment Facility (GEF)
Climate Action Network (CAN)
C40
Greenpeace
Conservation International
Friends of Earth International (FOEI)
Local Governments for Sustainability-ICLEI
World Resources Institute (WRI)
The Climate Group
Fridays For Future

United Nations Framework Convention on Climate Change



SUSTAINABLE DEVELOPMENT GOALS

SDG Goals Relevant to Greenhouse Gases

SDG	SDG Goals Relevant to Greenhouse Gases
	**Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable** • Reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management • Substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, and develop and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015–2030, holistic disaster risk management at all levels
	**Goal 12. Ensure sustainable consumption and production patterns** • Achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water, and soil in order to minimize their adverse impacts on human health and the environment • Rationalize inefficient fossil-fuel subsidies that encourage wasteful consumption by removing market distortions, in accordance with national circumstances, including by restructuring taxation and phasing out those harmful subsidies, where they exist, to reflect their environmental impacts, taking fully into account the specific needs and conditions of developing countries and minimizing the possible adverse impacts on their development in a manner that protects the poor and the affected communities
	**Goal 13. Take urgent action to combat climate change and its impacts** • Integrate climate change measures into national policies, strategies, and planning

- Keeping in view the growing urbanization, it is estimated by 2050 two-third of all the human population will be dwelling in cities and urban centers.
- The unplanned growth of urban centers leads to the formation of slums that causes humans to live in sub-par living condition.
- The aim of the SDG is to create sustainable job opportunities and develop safe and affordable housing societies.
- The goal also involves creating affordable public transport facilities, green public spaces and improving urban planning and management.

- The basic goal is the efficient management of our shared natural resources.
- No growth and development can be sustainable unless we reduce our ecological footprints by changing the way we use our natural resources for production and consumption.
- It is aimed that by 2030 we have to change our production and consumption pattern to make it more sustainable and environment friendly.
- It is estimated that while 1.3 billion tonnes of food is wasted globally each year, 2 billion people go hungry. The global goal is to change this sad state.

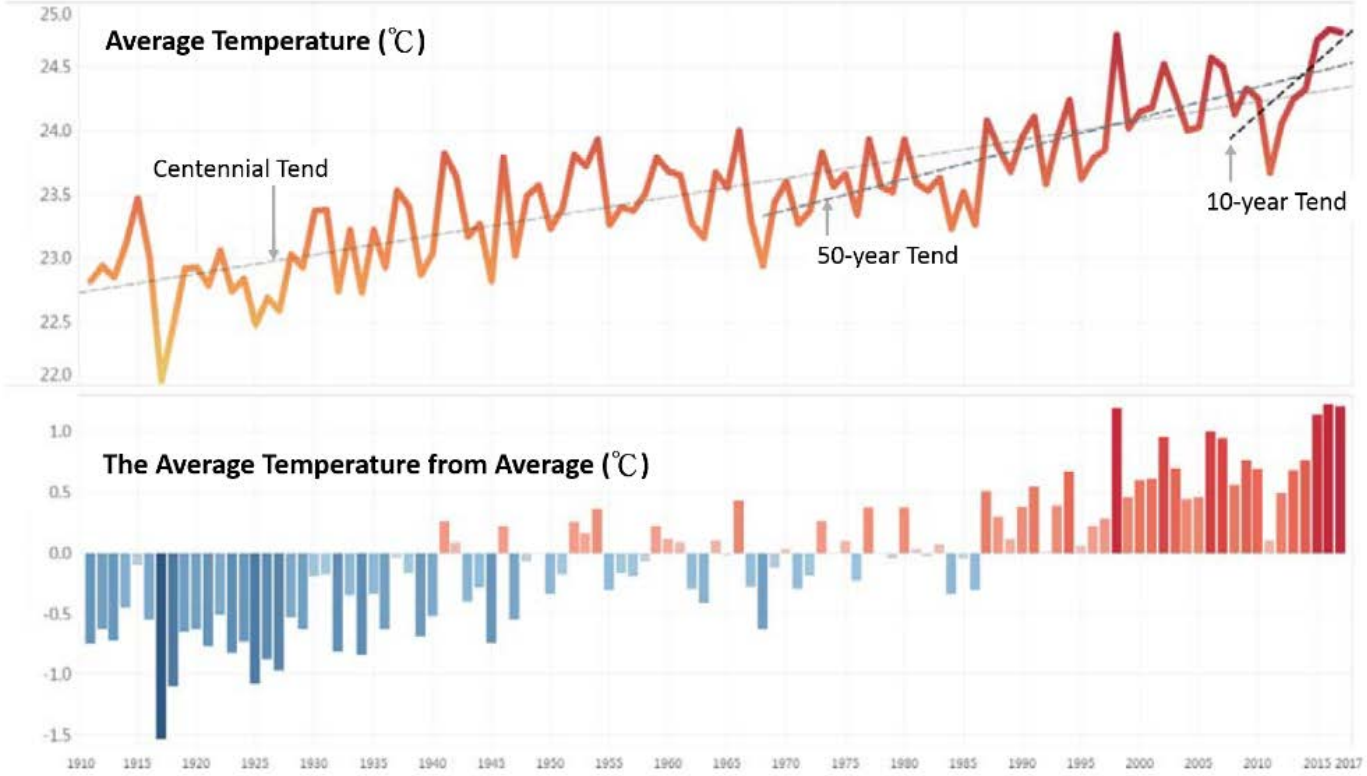
- The global community is experiencing drastic effects of climate change.
- Climate action aims at limiting the global rise in temperature to two-degree Celsius above the pre-industrial level.
- It is estimated if bold actions are taken to achieve this goal, an economic benefit at least of 26 trillion US dollars will be triggered by 2030 in addition to the other non-monetary benefits.

Call for More Strong Climate Action

- Global temperature has risen by 1.1 C above pre-industrial levels.
- Millions of people face livelihood loss due to weather extremes, resulting in hunger, conflict or displacement.
- By 2030, an estimated 700 million people will be at risk of displacement due to drought.
- **To limit warming to 1.5 C**, global greenhouse gas emissions must fall by 43% by 2030 and to zero by 2050. But current climate actions are not enough to achieve target.
- Up to 100 million people will be risk of hunger by 2030 (World Bank) if countries do not meet the targets of SDG 13.

Climate Change in Taiwan

- **Surface temperature in Taiwan has been increasing for 100 Years**
- Compared with the average temperature during 1986-2005, the temperature in Taiwan at the end of 21st century (2081-2100) in RCP4.5 and RCP8.5 scenarios may increase by 1.3°C to **1.8°C** or 3.0°C to **3.6°C** respectively.



Temperature Record from in Taiwan 1900 to 2017

*RCP: Representative Concentration Pathways

Key initiatives and actions that Taiwan had undertaken to tackle Climate Crisis

‘Pathway to Net-Zero Emissions in 2050’ plan (2022)

- Outlines 4 major transformations in energy, industry, lifestyle and society.
- It also includes two essential governance foundations in technology R&D and climate legislation, supported by **12 key strategies**.
- These strategies encompass renewable sources (wind and solar, hydrogen, innovative energy), energy systems (storage, savings and efficiency), de-carbonization (capture, sinks and carbon-free vehicles), zero waste, green lifestyle, green finance and just transition.
- **To achieve net-zero emissions by 2050**, Taiwan aims to increase the share of renewables and natural gas in its energy mix to 20 per cent and 50 per cent respectively, while reducing the share of coal to 30 per cent by 2025.

Health for All
Taiwan
Can Help

Combating
Climate Change
Taiwan
Can Help

Key initiatives and actions that WMA had undertaken to tackle Climate Change

WMA's work representing the more than 11 millions of physicians worldwide. Acting on behalf of patients and physicians, the WMA endeavors to achieve the highest possible standards of medical care, ethics, education and health related human rights for all people. This blog will chronicle these travels and important issues.

SUMMIT-STATEMENT-Climate-and-Health_F – Uploaded Fri, 20/01/2017 in Media

SUMMIT-STATEMENT-Climate-and-Health – Uploaded Fri, 20/01/2017 in Media

WMA Welcomes Recognition Given to Health in New Climate Deal – Uploaded Sat, 12/12/2015 in News & Press

Health must be given higher priority in climate summit say physician leaders – Uploaded Thu, 28/05/2015 in News & Press

The Global Climate and Health Alliance – Uploaded Fri, 15/11/2013 in News & Press

WMA Declaration of Delhi on Health and Climate Change – Uploaded Sat, 17/10/2009 in Policy

WMA Proposes Action Plan to Protect Health from Climate Change – Uploaded Sat, 17/10/2009 in News & Press

Doctors' Leader Criticises Governments for Paying Poor Attention to Heath in Climate Change Debate – Uploaded Fri, 16/10/2009 in News & Press

Physicians to discuss Health Consequences of Climate Change – Uploaded Tue, 09/06/2009 in News & Press

WMA Resolution on Climate Emergency – Uploaded Sun, 27/10/2019 in Policy

Physicians Warn Against Neglecting Health in Climate Talks – Uploaded Tue, 09/05/2017 in News & Press

21st Conference of the Parties of the UN Framework Convention on Climate change (COP21) – Uploaded Mon, 23/11/2015 in News & Press

WMA Supports New Call to Action on Climate Change – Uploaded Tue, 06/10/2015 in News & Press

WMA Welcomes New Report on Climate Change and Health – Uploaded Tue, 23/06/2015 in News & Press

WMA calls for urgent action on climate change to protect health – Uploaded Thu, 18/12/2014 in News & Press

It's Hot Outside – Climate Change – Uploaded Thu, 08/08/2013 in News & Press

Climate Change, WMA Member Survey – Uploaded Tue, 16/04/2013 in News & Press

Health Organisations Urge Immediate Action to Tackle Climate Change – Uploaded Mon, 03/12/2012 in News & Press

Climate Change Has Health Consequences – Uploaded Tue, 16/10/2012 in News & Press

Emergency funding needed to combat climate change, says WMA – Uploaded Fri, 20/10/2017 in News & Press

World Medical Association Condemns President Trump's Climate Change Announcement – Uploaded Fri, 02/06/2017 in News & Press

Physicians' New Year Hopes for Climate Change – Uploaded Fri, 30/12/2016 in News & Press

Climate Change – Uploaded Tue, 22/11/2016 in What We Do

Physicians Need to Play Key Role in Combating Climate Change – Uploaded Mon, 07/11/2016 in News & Press

WMA Climate Change – Uploaded Mon, 11/07/2016 in News & Press

Doctors Around the Globe Tackle Climate Change and Fossil Fuels – Uploaded Fri, 04/12/2015 in News & Press

Physician Leaders Call for Health to be Protected in Climate Change Agreement – Uploaded Wed, 25/11/2015 in News & Press

Guidelines for WMA delegation to UN Climate Change Conference – Uploaded Fri, 30/06/2023 in Media

Concept Note_ A WHA Resolution on Climate Change and Health_September 2022 – Uploaded Wed, 14/09/2022 in Media

Physicians Demand Accelerated Action on Climate Change – Uploaded Mon, 28/10/2019 in News & Press

Health, environment and climate change – Uploaded Fri, 17/05/2019 in Media

Health, environment and climate change – Uploaded Mon, 21/01/2019 in Media

Why doctors need to join the fight against climate change – Uploaded Mon, 10/12/2018 in News & Press

11.4 Health, environment and climate change – Uploaded Sat, 19/05/2018 in Media

3.5 Health, environment and climate change-WMA – Uploaded Sun, 21/01/2018 in Media

Health professionals supporting WHO call for governments to meet their climate obligations.(Oct.23, 2023)

COP-28, in Dubai, UAE, has recognized the growing climate and health emergency and is hosting the first ever Health Day on 3 December 2023

As stated by Dr Tedros: "Addiction to fossil fuels is not just an act of environmental vandalism. From the health perspective, it is an act of self-sabotage.“

A COP28 Climate and Health Declaration will be delivered by health ministers and governments gathered in Dubai in December 2023

WHO urges health professionals, groups and individuals to unite in a call for world leaders to meet the commitments they have already made, and to raise their ambition for a healthier, fairer and greener future:

1. deliver on the Paris Agreement and accelerate the phase out of fossil fuels to safeguard a liveable future for humanity and save a million lives a year from air pollution;

2.build climate-resilient, low-carbon health systems as “no regrets” protection for current and future lives; and deliver on promises of US$ 100 billion a year in climate finance, and target this on saving lives and improving the health of the most vulnerable.

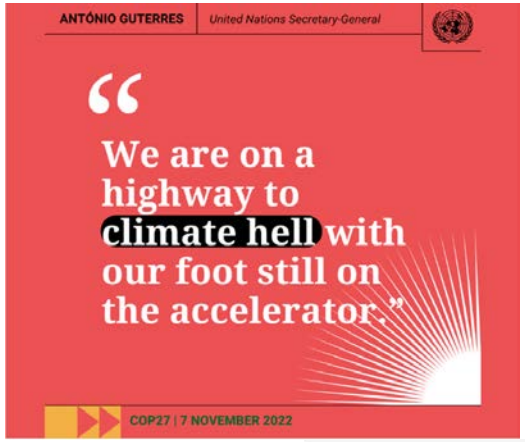
Declaration on “UNITING FOR HEALTH AND CLIMATE ACTION”

- Co-signed by WMA -

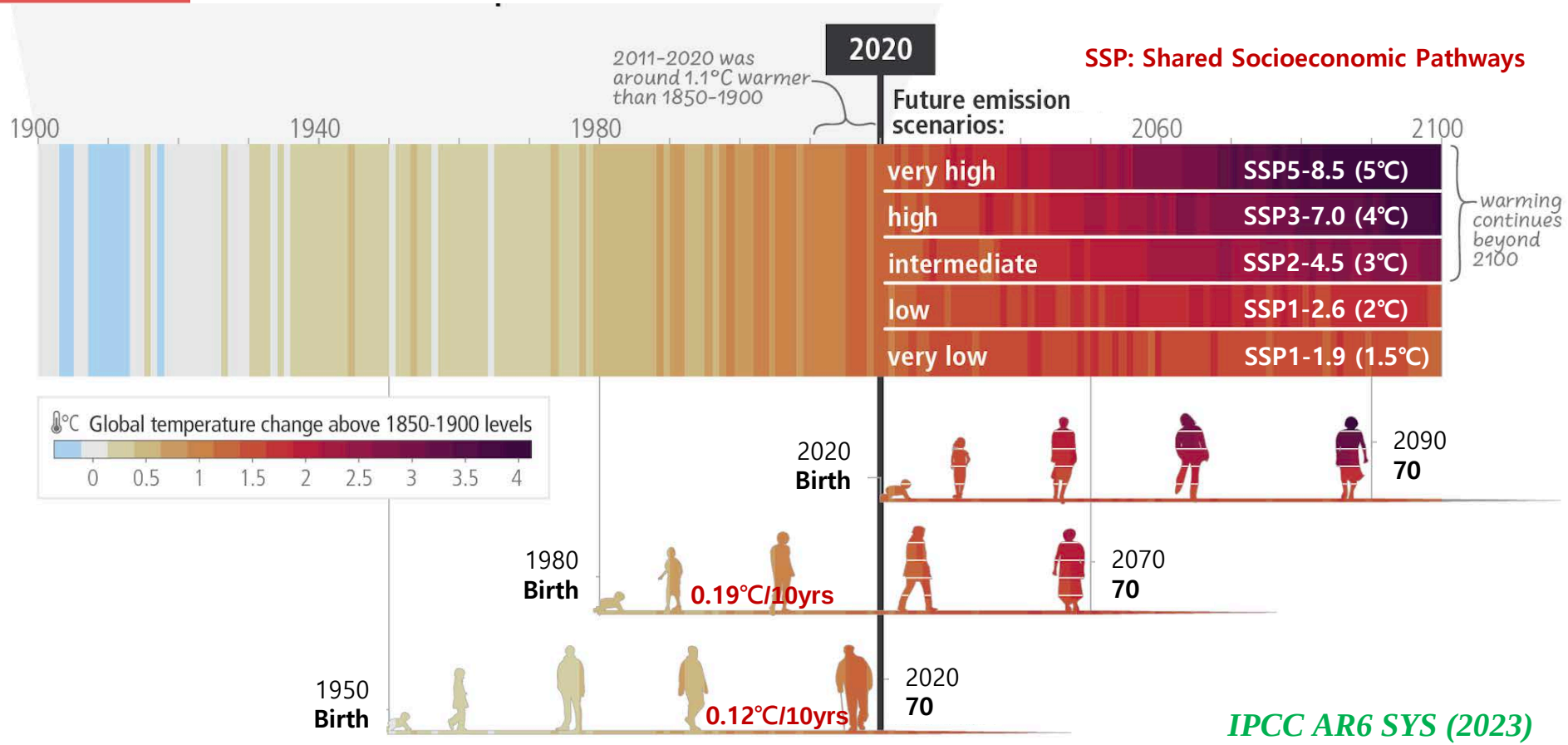
2023 KMA Annual Congress

- On-line, Nov. 12, 2023
- Pre-Registration : 9,003
- **Main Theme:**

  "Climate Change and Medical & Healthcare in Korea"



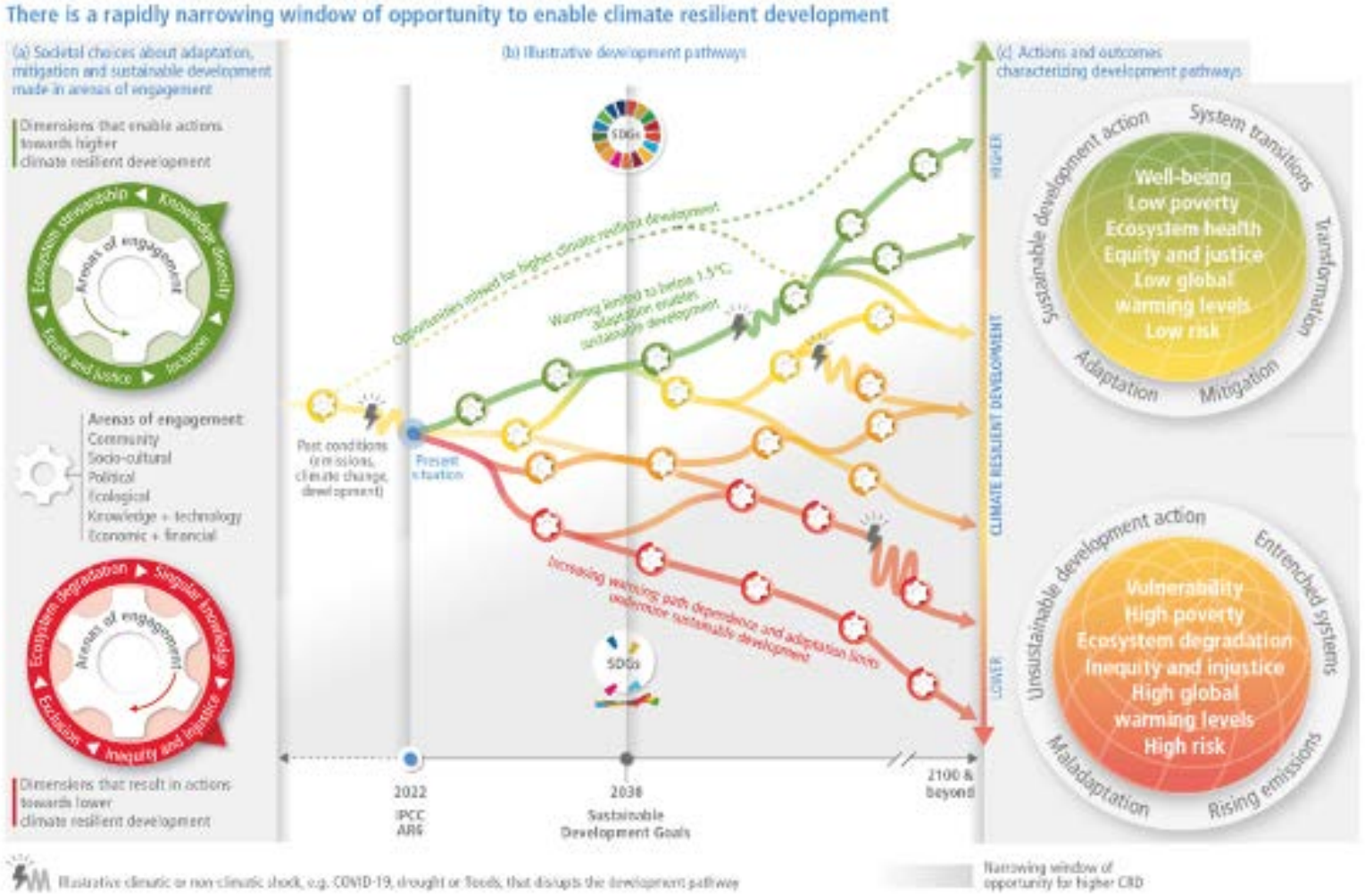
The degrees of global heating depends on our choice !



IPCC AR6 SYS (2023)

Next 10 years will determine sustainability !

SDGs



Present **2030**

IPCC AR6 WG II

Crisis, Challenge, Choice, Chance !!!

- **Climate Crisis** is a health crisis! More extreme whether exacerbates food deprivation and fuels the spread of infectious diseases.
- Air pollution kills more than 7-10 million people every year since 2020 !
- The same emission that cause global warming are responsible fore more than ¼ of deaths from heart attach, stroke, lung cancer and chronic respiratory disease.
- We need to move to 100% renewable energy **by 2045** !

- We **only have 12 years** to limit global warming to a maximum of 1.5C and avoid climate breakdown.
- Oceans store and release CO2 very slowly- atmosphere will heat up for several more decades even we stop producing it!
- With the 2030 Climate Target Plan, the Commission proposes to raise the EU's ambition on reducing greenhouse gas emissions to at least 55% below 1990 levels by 2030.

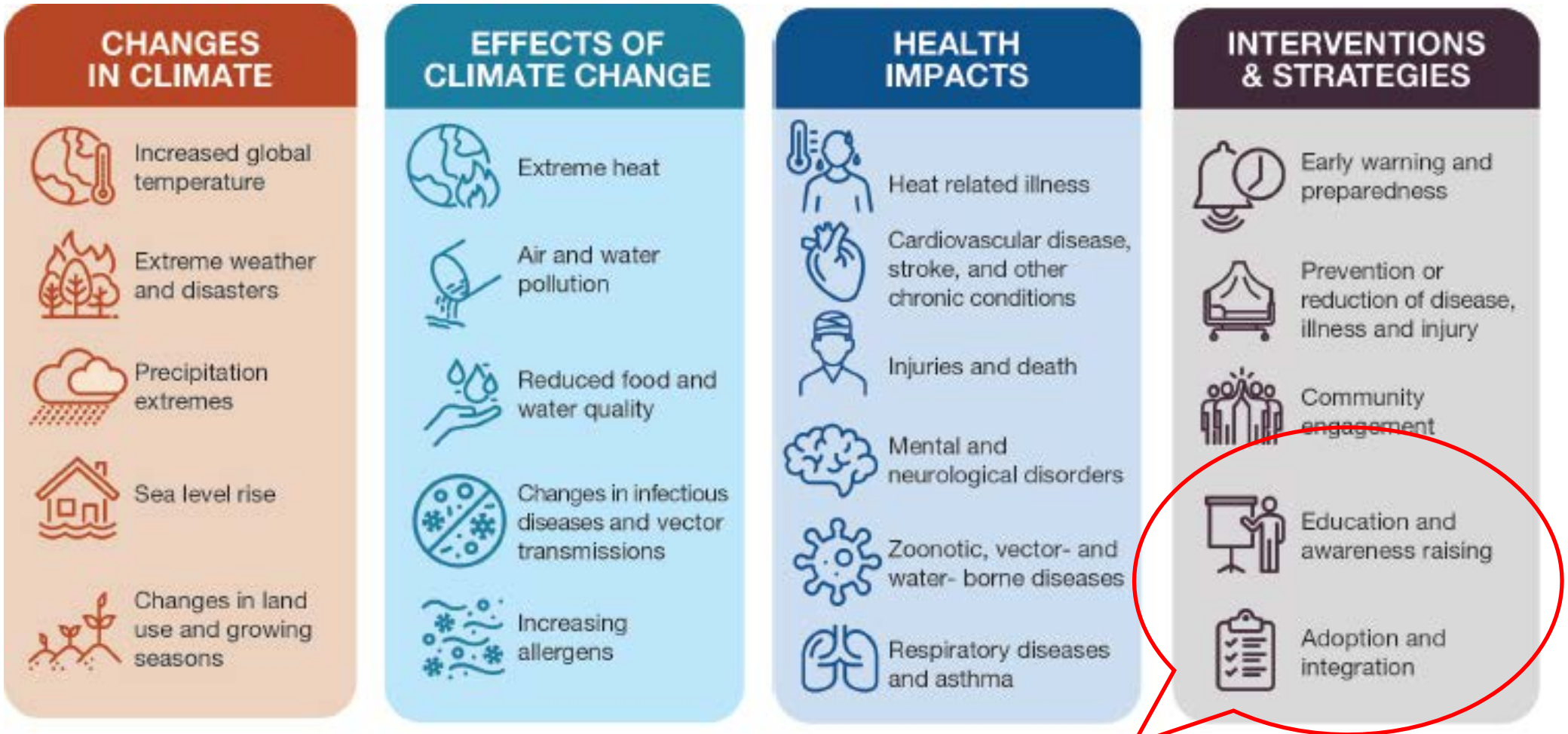
WHY CLIMATE ACTION IS URGENT

- Earth is already warmed by 1.12 degrees since pre-industrial levels.
- **Cap warming (tipping point)** at 1.5 degrees, the limit at which we can halt the worst impacts of climate change.
- Even at **1.5 degrees** there is likely to be ice free summers in the artic and around 70% of the worlds coral reefs lost. But **2 degrees** will result of ice free and the loss of nearly all the worlds coral reefs.
- We need to cut man-made greenhouse gas emissions drastically, phase out fossil fuels and move to renewable energy.

- We need to be more efficient and use less energy, and we need to tackle deforestation and eat less meat.
- **Global warming will exceed 1.5°C in the 2020s and 2°C before 2050.**
- But at the moment, even if all the governments of the world acted on the promises they have made, we would still reach **2.8 degrees in 2100**.
- We are a long way off those promises being turned into reality..

The timeline of climate change

Interventions and Strategies



Call for Action: Adoption, Implementation & Integration of Climate Medicine in Continuum of Medical Education

Please click the link below to join the webinar:
https://ucdenver.zoom.us/j/96311461344

Please join the CU Climate and Health Program for

CLIMATE MEDICINE ROUNDS

Tuesday, March 15, 4-5pm MDT

"Physician Advocates: Opportunities for System-Level Change"

Featuring the following guest speakers:

Senator Faith Winter,
CO General Assembly
Democrat, 24th District.
Chair
Transportation
and Energy Committee

Representative
Kyle Mullica
CO General Assembly
Democrat, 34th District
Trama Nurse

Dr. Cory Carroll

Family physician in Fort Collins who has served as president of the Larimer and Colorado Medical Societies.

Moderated by Eric P. Balaban, MD

Climate Health Policy Fellow

Please click the link below to join the webinar:
https://ucdenver.zoom.us/j/96311461344

Climate and Health Program
SCHOOL OF MEDICINE
UNIVERSITY OF COLORADO
ANSCHUTZ MEDICAL CAMPUS

Teaching Climate Change in Med School Gains Momentum

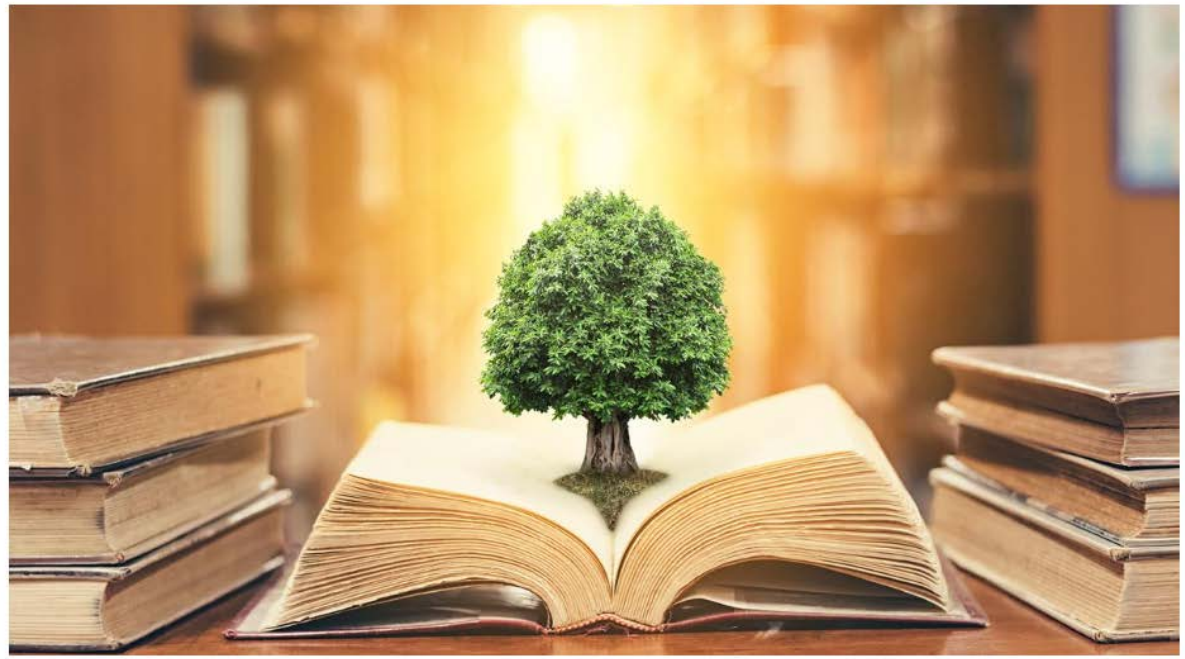
— Climate-and-health training is "fundamental to the mission of medicine," expert says

by Amanda D'Ambrosio, Enterprise & Investigative Writer, MedPage Today September 21, 2022

Last Updated September 22, 2022

AAMC

As the impacts of climate change on health become more prominent, a growing number of medical schools are adding climate-related content to the curriculum.



By Beth Howard

(actual dates may vary and content is subject to change)

	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Year 1	M1 Orientation	Healthy Human				Human Disease						
		Foundations Thread Courses (Microbiology, Pharmacology, Biochemistry, Immunology, Physiology, Pathology, EBM)										
	Week on the Wards	Small Group - Essentials of Patient Care (EPC)										
		Community Learning & Social Medicine (CLSM)										
					Outpatient Clinical Experience (OPEX)							
					Anatomy							

Year 2	PHASE 1 - cont'd	USMLE Step 1	PHASE 2: APPLICATION OF MEDICAL SCIENCES
	Human Disease - cont'd		Core Clinical Rotations include: Surgery, Medicine, Pediatrics, Psychiatry, Neurology, OB-GYN, Dermatology, Ophthalmology, Palliative Care, Anesthesiology, Primary Care, Radiology, and Ethics
	Foundations Threads - cont'd		
	Small Group - EPC - cont'd		Small Group - Clinical Years
	OPEX - cont'd		
	M2 Elective		

Year 3	PHASE 2 - cont'd	USMLE Step 2	PHASE 3: DISCOVERY
	Core Clinical Rotations - cont'd		
	Small Group - Clinical Years - cont'd		

Year 4	PHASE 3 - cont'd	PHASE 4: TRANSLATION OF MEDICAL SCIENCES
		Emergency Medicine, Critical Care, Sub-Internship, Electives, Residency Interviews / Capstone

Longitudinal Threads (all 4 years):

- Diversity, Equity, Inclusion, and Racial Advocacy (DEIRA)
- Climate Change and Environmental Health (CCEH)
- Clinical Decision-Making
- Interprofessional Education (IPE)
- Financial Literacy
- Career Advising & Planning (EmoryDOCS)
- Ethics in Medicine

Emory University to Update Medical School Curriculum to Include Climate Risks

By EcoWatch | Sep 17, 2021 2:15AM EDT

HEALTH + WELLNESS

Climate, Health, and Equity Curriculum

University of CINCINNATI COLLEGE OF MEDICINE

Mitchell Singstock, Leah Barnes, Nick Weissman, Natalya Bondarchuk, Alexis Corcoran, Jacqueline Meystedt, Allie Richards, Dr. Bruce Giffin

Introduction

- Climate change is increasingly becoming a public health concern
- The World Health Organization states that climate change is "**the greatest threat to global health in the 21st century**" and now attributes almost a quarter of deaths and global disease burden to environmental degradation. (WHO 2021)
- "The life of **every child born today** will be **profoundly affected by climate change**, with populations around the world increasingly facing extremes of weather, food and water insecurity, changing patterns of infectious disease, and a less certain future." (The Lancet Commision 2019)
- Both the **AMA** and **OSMA** support teaching the health effects of climate change in medical education. (AMA 2019, OSMA 2022)
- Yet, only 15% of medical schools have incorporated such topics into their curriculums. (Omnia 2020)

The Climate, Health, and Equity (CHE) curriculum was designed by students to address this gap in knowledge and was inspired by the findings of UCCOM's Planetary Health Report Card (PHRC).

Purpose

To integrate topics of **planetary health** and **environmental justice** throughout UCCOM's curriculum in an evidence-based and apolitical manner so medical students can be prepared for today and tomorrow's healthcare challenges.

Example Slides

Extreme Heat (above) **Environmental Degradation (below)**

Curriculum Schematic

Topics to be included in the curriculum were identified based on UCCOM's PHRC. Slides were designed to be stand-alone so they would pose as small a burden on course instructors as possible. When applicable, slides were modified with permission from other institutions or non-profits. Attention was given to emphasize content relevant to Ohio.

M1

Physician and Society*
- Introduction to Planetary Health

Molecular/Cellular
Medicine
Blood Systems

Physician and Society
- Environmental Justice
- Environmental Degradation

MSK
Nervous System
- Mental Health
- Neurologic Health

M2

Cardiovascular/ Pulmonary*
- *Extreme Heat*
- *Air Pollution*
- *Allergies and Asthma Patient Scenario*

Renal/GI*
- Infectious Disease
- Water Quality
- Food and Water Insecurity

Endocrine/ Reproductive
- Reproductive Health

Blood Systems
HCEM
- Extreme Weather

M3-M4

Rotations
- Carbon Footprint of Healthcare
- Sustainable Healthcare Practices

*Topics whose corresponding slide

Results

To date, we have completed stand-alone slides for the Cardio/Pulm and Renal/GI courses.
As the year progresses, the remaining course topics will be completed and integrated into the curriculum.
It is estimated that the integration of these 12 major topics will improve UCCOM's curriculum score on the PHRC from and **F to a B**.
This will improve the school's overall PHRC grade from a **D- to a C**

Future Directions

Academic Year 2022-2023
- Complete and integrate slide decks for all M1 and M2 courses
- Create forms to collect student and course director feedback with the goal to continually improve the curriculum
- Design clinical and problem-based learning scenarios

Academic Year 2023-2024
- Collaborate with local climate-oriented nonprofit for M1 Physician and Society service project
- Work with the Ohio State University College of Medicine and the Climate Resources for Health Education project to create a series of slide decks for all Ohio medical schools

Acknowledgements

We would like to thank Medical Students for a Sustainable Future for their guidance in creating the PHRC and UCCOM course directors for their ongoing support.

References

Contact info

Questions or interested in joining our effort?
Please contact us at:
singstmd@mail.uc.edu
mssfc@gmail.com

Education

May 31, 2022

Promoting planetary health: U-M Medical School students, administrators partner on climate issues

Among the latest efforts: A public report card on medical schools' efforts to tackle climate change

UNIVERSITY OF MICHIGAN
MEDICAL SCHOOL
MICHIGAN MEDICINE

WCPH
White Coats for Planetary Health

COLUMBIA | MAILMAN SCHOOL OF PUBLIC HEALTH

≡ MENU

< Research

Global Consortium on Climate and Health Education

≡ Section Menu

Fellowships & Internships

Fellowships, internships and opportunities available to interdisciplinary health professional students are detailed. If the application deadlines are closed for this year, please continue to check back for deadlines for the next cycle.

- Climate and Health Education Student Fellowship
- Opportunity for PhD Students and Early Career Researchers interested in International Health System Sustainability and Adaptation for Climate Change

Climate change, effects to be part of medical school syllabus

Hemali Chhapia / TNN / Updated: Feb 15, 2023, 00:58 IST

SHARE | AA | FOLLOW US

You're Reading

Climate change, effects to be part of medical school syllabus

Brighten your Diwali with OnePlus products under INR 30,000, including th...

MUMBAI: In a landmark move, the health effects of climate change will soon be included in all medical courses across the country.

EMORY UNIVERSITY SCHOOL OF MEDICINE

Resilience and Sustainability Collaboratory

Climate Change and Medical Education

Rebecca Philipsborn, MD, MPA
Emory University School of Medicine
Emory Resilience and Sustainability Collaboratory

March 31, 2021

HARVARD
Global Health Institute

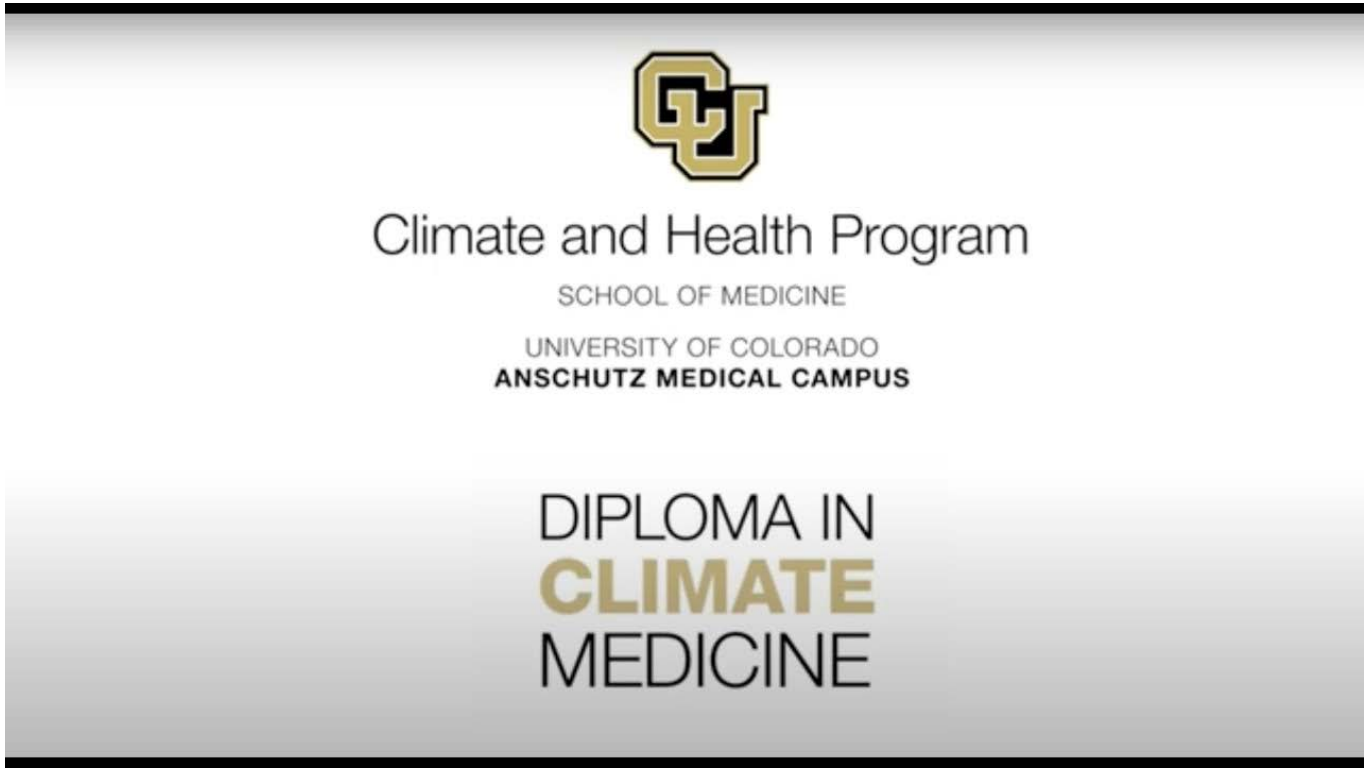
Introducing the Burke Climate and Health Fellowship

In partnership with the Salata Institute for Climate and Sustainability, the Harvard Global Health Institute is excited to announce that we are now offering a 2-year fellowship program for eligible research fellows, post-doctoral scholars, and early career faculty pursuing scholarly research at the intersection of climate change and global health. The Burke Climate and Health Fellowship will support fellows as they work closely with Harvard faculty mentors in any school or department on their proposed research project.

The Burke Climate and Health Fellowship is made possible through the generous support of Harvard alumna Katherine States Burke, AB'79, and her husband, T. Robert Burke, who established the Burke Fund to help launch and advance the careers of promising early career researchers in global health.

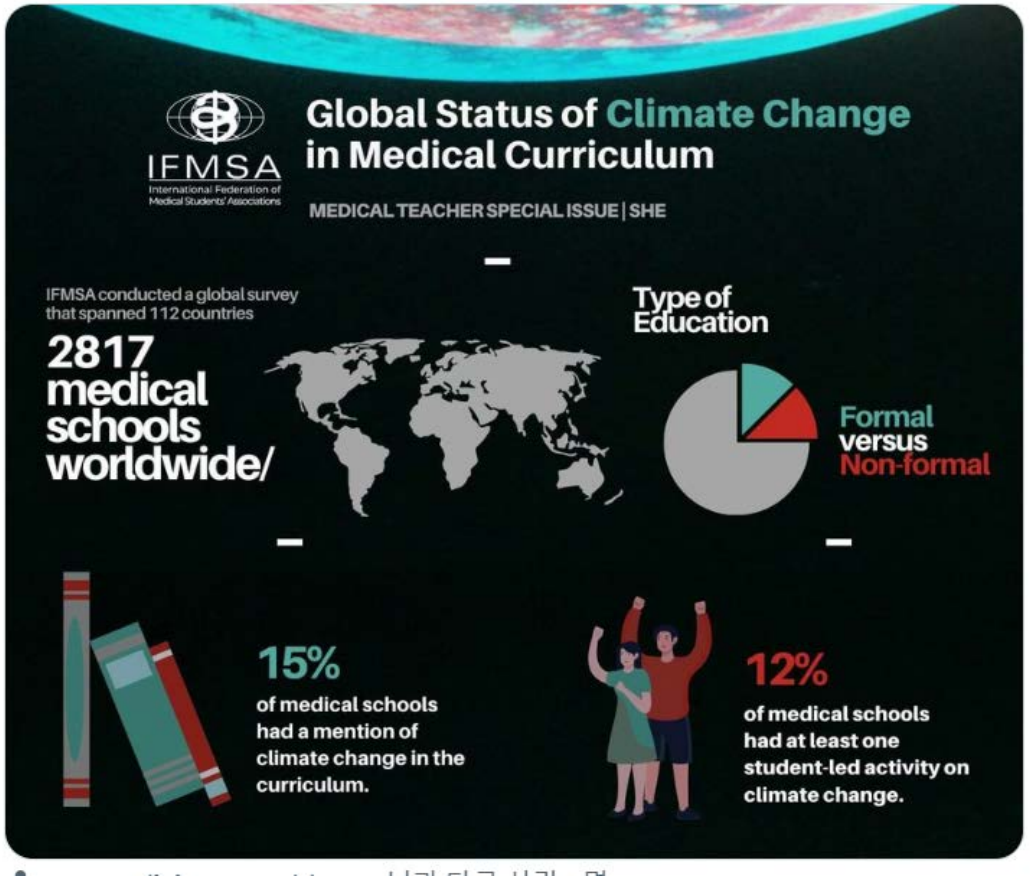
Harvard Medical School votes to embed climate change in its curriculum - The Boston Globe

Jay Lemery, MD, professor of emergency medicine, has been named the inaugural Endowed Chair in **Climate Medicine**. The endowed chair will give Lemery resources to support teaching and research that prepares physicians to be leaders in climate and health.



Climate Change in Medical School Curriculum

- 55% of Medical Schools in U.S. teach Climate Change (2023) compared to 27% (2019)
- IFMSA survey revealed that climate change is taught in only 15% of medical schools worldwide.(2020)



The next frontier in medicine: Doctors with climate training |

Urgent Need for Medical Education Efforts !

- Climate change is a public health emergency.
- Clinicians worldwide now face the reality of caring for patients during wildfires, heat waves, floods, and shifting infectious disease patterns. Health-care workers need better preparation to care for communities facing the health effects of climate change.
- There is a **lack of** or not enough of, curricula teaching climate change within medical education.

- Need a comprehensive framework for content and implementation of all related issues of climate change and impact on health as an independent course.
- Although some medical schools have begun to incorporate CCH into curricula, the inclusion usually lacks a comprehensive framework for content and implementation.
- Need to adopt, and implement the determined the goals and desired outcomes of the curriculum with objectives, competencies, and milestones; and strove to integrate CCH goals into as many existing curricular settings.

Climate Medicine

- **Climate Medicine** is dedicated to treating the health effects of climate change, to finding ways to reduce harm and to protect the health of humankind and of our planet.

- **Scopes and Aims of Climate Medicine**
  - Introducing Climate Change to all levels of medical education.
  - Advocating for climate-resilient policies.
  - Credibly addressing deeply rooted environmental justice issues.
  - Effectively leading health systems to de-carbonize.
  - Fostering specialists in Climate Change

Climate Medicine: Need for Continuous Learning

- Climate change is a key threat to human health worldwide.
- Accordingly, medical education should **prepare future physicians** for climate-associated hazards and corresponding professional challenges.
- Initial approach needs to minimize competition for time with existing content and allows mapping of content to existing curricular competencies and milestones, while encouraging a broad understanding of CCH in the context of individual patients, populations, and communities

Medical schools must prepare students to work in a world altered by climate change

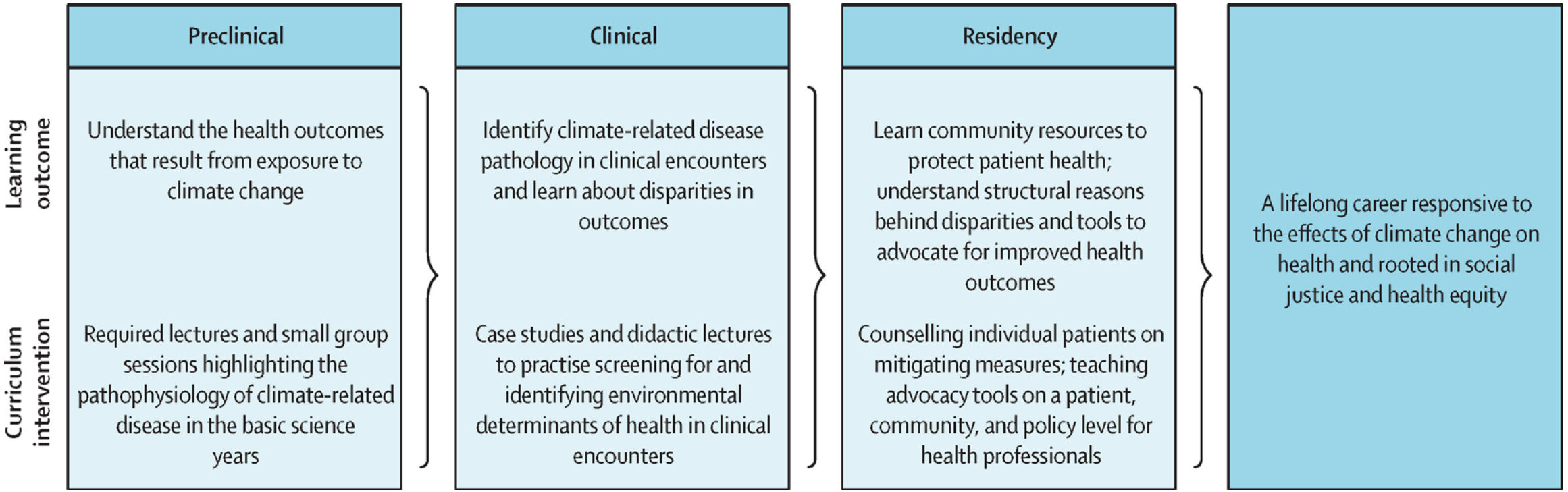
By Anna Goshua March 19, 2019 Reprints

Low water levels are seen visible on the banks of Entrepenas reservoir in Duron, Spain, in 2017, when it was at its lowest level since 1994.

DAVID RAMOS/GETTY IMAGES

Implementation & Integration of Climate Medicine in Continuum of Medical Education

BME-PME-CME/CPD



LANCET PLANETARY HEALTH. VOLUME 7, ISSUE 1, E2-E3, JANUARY 2023

Preclinical Curriculum

- Introduction of Climate Science, Ecology, Geology, Earth Science, etc.
- Highlighting the effect of climate change on disease pathophysiology across human health.
- Incorporate climate topics into pre-existing course materials using an equity lens, emphasizing the disproportionate health effects of climate change on low-resourced communities.
- Identify air pollution and heat exposure as environmental teratogens that increase the risk of adverse birth outcomes, especially for vulnerable population.
- **Early exposure** to areas influenced by climate change and regular field trips in real settings

- Flipped learning and small group discussion with facilitators
- Transitioning to clinical integration, our team expanded on knowledge gained in the preclinical setting to teach students how to identify climate-related disease pathology.
- Integrate climate and health effects into relevant didactic sessions and case presentations.
- Open sessions to learn how to discuss climate-related topics in patient encounters.
- Design and implementation of clinical and PBL modules

Clinical Clerkship

- Explore physiologic, ecologic and social interactions resulting in these impacts and provides a foundation in climate medicine and skills in science communication, policy and advocacy.
- Identify climate-related disease pathology in clinical encounters and learn about disparities in outcomes.
- Aim to equip junior doctors with tools to counteract climate change's impacts on patients with emphasis on how climate and health presentations are rooted in upstream factors that contribute to health inequities.

- Provide climate-related patient education, and connecting junior doctors with advocacy resources.
- Case studies and didactic lectures to practice screening for and identifying environmental determinants of health in clinical encounters.
- Learning opportunities in ER for urgent cases and environmental settings
- Presentations and debriefing

Residency and PGME

- Learning community resources to protect patient health; understanding structural reasons behind disparities and tools to advocate for improved health outcome.
- Counselling individual patients on mitigating measures; teaching advocacy tools on a patient, community, and policy level for health professionals.
- A longitudinal approach to climate and equity education throughout medical training aims to not only build competency and awareness on the effects of climate change on health, but also provide an equity frame .
- Provide opportunities for a career rooted in social justice and health equity.
- Advancement of learning for degrees and becoming professional career in climate medicine for interested individuals.

CME/CPD: Lifelong Learning

- Bioclimatology, Environmentology, Meteorology, Geomedicine, Environmental Medicine
- Lifelong career responsive to the effects of climate change on health and rooted in social justice and health equity
- Provide continuous learning environment: Apps & Web-based protocols

- Volunteering & active involvement in global climate network, NGO & communities
- Leadership
- Advocator
- Mentor
- Manager
- Policy Maker

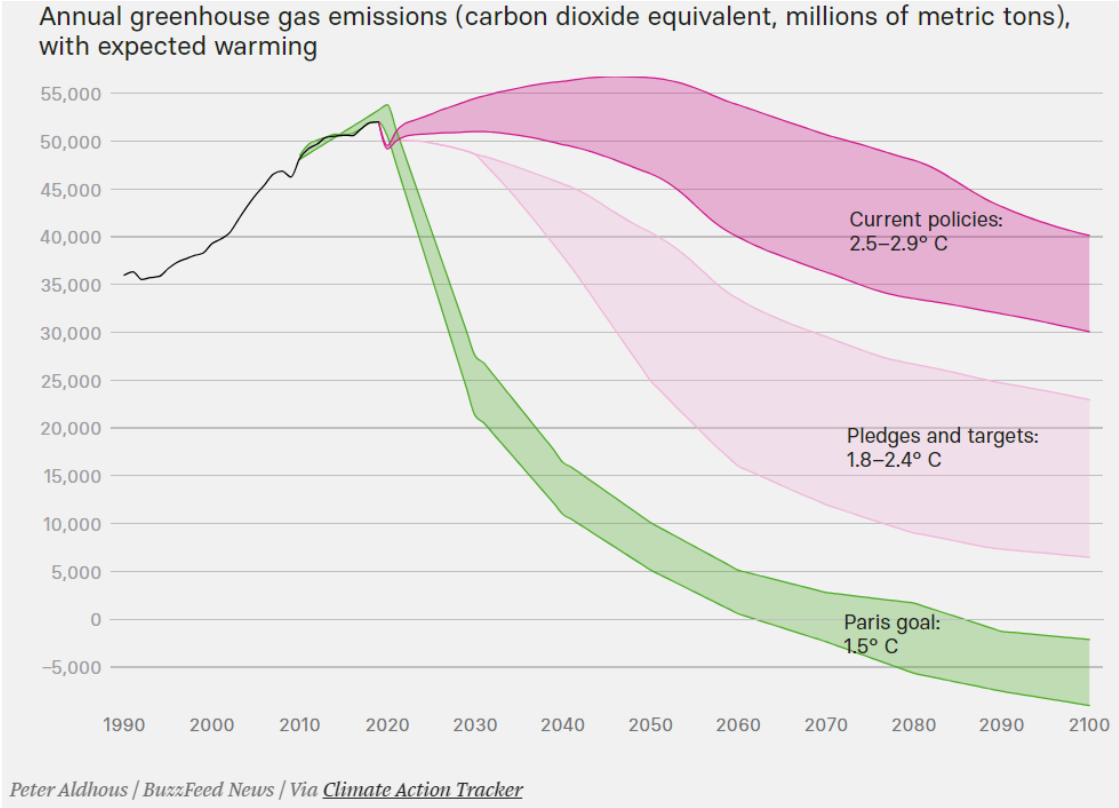
Climate Medicine in Future

- **Education Reform**: Implementation & Integration of **Climate Medicine** into Continuum of Medical Education: BME-PGME – CME/CPD
- Educational and Training Protocols with Digital Portfolios with regular assessments: Medical Students, Residents, Primary Physicians & Specialists
- Field trips, early exposures, participation in urgent situations
- Development of Faculty & Specialists, Subspecialists
- **Assessment** Tools, Standardization

- Preparation of textbooks, curricular materials, and guidelines
- Global Networks: Information sharing, Learning, Teaching
- Governance: Leadership. Outreach & Government Engagement, Funds
- International Collaboration, Cooperation, Solidarity
- Active Involvement by Global Professional Societies in Medicine and Healthcare
- **Accreditation** program

Take Home Message

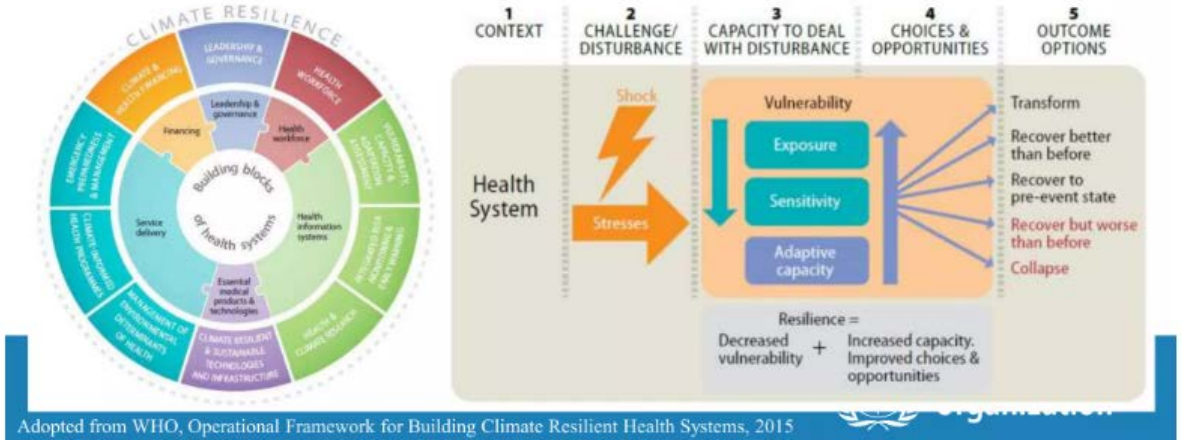
- Global temperature has risen by 1.1 C above pre-industrial levels.
- Millions of people face livelihood loss due to weather extremes, resulting in hunger, diseases, conflict or displacement.
- Limit of heat tolerance is 1.5 C rise (cap warming "tipping point".
- To limit warming to 1.5 C, global greenhouse gas emissions must fall by 43% by 2030 and to zero by 2050. But current climate actions are not enough to achieve target. (**Climate Crisis!**)
- Need to be prepared for different/worse scenarios from evolving climate change



- Requires attentions/action not only from organizations and governments but also from each and every healthcare professional
- Needs to advocate and drive policy and decision makers and public worldwide
- Strong solidarity and collaboration globally
- Needs to prepare and establish the climate resilient health system
- Education on **Climate Medicine** should be adopted and implemented in all levels of medical education curriculum including continuous professional development (CPD)

Climate resilient health systems

- WHO's definition
  - is one that is capable to anticipate, respond to, cope with, recover from and adapt to climate-related shocks and stress, so as to bring sustained improvements in population health, despite an unstable climate (WHO, Operational Framework for Building Climate Resilient Health Systems, 2015)



Hope for the FUTURE!

JVM_C011


謝謝！감사합니다